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VOL. CLII., No. 2998.] WEDNESDAY, OCTOBER 27, 1920. [72ND YEAR.

EDITORIAL NOTES.

The Coal Strike and Constitutional Procedure.

ALL last week the country was kept on thorns as to what would be the course of action of the partners in the Triple Alliance in giving support to the miners in their arbitrary and ruthless policy, and in assisting them in their attempt to force from the Government an advance in wages before submitting the matter to an independent and impartial tribunal. Most unions were desirous of a quick settlement; and their hope was heartily shared by the whole community, providing the settlement was a fair one. There were good causes for the hope; for in addition to the waste and loss, the roll of the workless through the miners' action mounted-up in alarming proportions daily, and the rate is bound to increase by leaps and bounds as the stocks of fuel near or reach the point of exhaustion. Mediation was spoken of; but no one among the union leaders outside the Miners' Federation appeared willing to take the first active step. The extremists were the noisiest during the week, and seemed to have got the upper hand over the moderates; and force rather than pacific mediation was the mad and prominent method of solution advocated, and was heard of most because of the silence on the other side. There was a debate in the House on Tuesday night which on the surface ended abortively; but, in reality, it showed that the road on both sides was wide open to negotiation if an acceptable plan could be devised. Mr. W. Brace, one of the Welsh miners' members, on the occasion put forward a scheme; but there was nothing in it which would guarantee, if the 2s. per day were conceded, that the miners would give an equivalent in coal output. Without impugning his sincerity, it may be said that Mr. Brace wanted something very tangible for something that was superlatively intangible. But it was all to the good to find miners' leaders, and influential ones, still seeking a way to end the fearful enormity which the Federation had committed by refusing to have their claim adjudicated upon by a competent tribunal, which would have been a constitutional course.

A constitutional course! Everything seemed for the most part last week to be taking an unconstitutional course in connection with the doings of some of the more imposing of the trade unions. The leaders of the unions protest against their members taking the unconstitutional course of indulging in unauthorized lightning strikes, so abasing the authority of the leaders. The majority of the leaders of some of these unions supported the refusal by the Miners' Federation of the constitutional course of a reference to an impartial tribunal. The railway and transport leaders said the miners' claim was justified; and the Trade Union Congress at Portsmouth made the same declaration. In doing this, they all ignored the right of any other parties—in this case the public—to the only constitutional means of satisfying themselves as to the legitimacy of the claim. When well through the greater part of the week, the delegates of the National Union of Railwaymen decided that, if active steps had not been taken to effect a settlement, there should be a general stoppage on all the railways at midnight on Sunday. Yet informal and unofficial consultations were even then going on between Ministers and members of the Miners' Federation in an attempt to find a basis upon which negotiation between the Government and the Federation could be resumed. Mr. J. H. Thomas very properly expressed his disagreement with the hotheads who were attempting to precipitate matters in this crude way, and who were, by so doing, setting an example—by defying the Government who were elected by the nation to govern—to their own members which, if utilized by them against their own leaders, would cause a torrent of indignation to flow from the latter. Example in policy and practice count for much. The railway men themselves were not consulted on the matter of a strike; and reports were published which showed that the Society of Locomotive Engineers and Firemen were not at all inclined to follow the lead of the N.U.R. extremist chiefs, and that there was a sharp cleavage in the membership of the latter as to the wisdom of throwing themselves out of employment to support men who are paid an average of 24s. 3d. per ton of coal raised. The Transport Workers are waiting the issue of conferences, though from that quarter, too, ugly threats were issued during the week, which there was sufficient reason to believe were unofficial and unrepresentative. All this extremist action is bad as an example; and it is having a double effect. It is encouraging the passionate ones in the Unions to further hotheadedness; and, on the other hand, it is causing the more level-headed, moderate, and honest men to become heartily sick of the increasing turmoil created by the ultraists in the executives of the unions, who have wormed their way to the front and into a controlling position. Only last week, some of the Welsh miners were talking of trying to force the issue, if a settlement was not agreed to by the end of the month, by calling upon the Federation to withdraw the men who are keeping the mines in a workable condition. This would be the game of fools. Further anarchist tendency was evidenced by another Welsh suggestion, that the miners should take forcible possession of the mines and work them on their own account. This country is not Italy; and the Italian extremists have learnt that there is a higher power in the land than themselves.

There are other ways of doing things. No doubt some of the leaders of the Miners' Federation were grateful to the majority of the Executive of the National Union of Railwaymen for their desire to pile chaos upon chaos in the effort to compel the nation's Government to bow to sectional desire and determination. But the Miners' Federation, knowing what had been passing between certain of the members of the Executive and the Government, had no desire to see any impolitic action taken that would have lessened the chances of a settlement. Moreover, prior to this the Parliamentary Committee of the Trade Union Congress had issued a statement strongly deprecating the taking of action by separate bodies which might defeat unity in the object of effecting a settlement. And, furthermore, the Miners' Federation were no doubt feeling that half-hearted support from the railwaymen would do their cause more harm than good. So it came about that at the request of the Miners' Federation, strike action by the railwaymen was postponed indefinitely. The firstfruits of the informal conferences to which reference has been made were seen in the meeting on Sunday between the Premier and representative members of the Executive of the Miners' Federation; and this was a sign that a real return was being made to constitutional procedure. The conferences are continuing; and it is stated that the favoured new ground of negotiation is for an advance based upon the value of increased output rather than quantity. At the moment, however, everything is in the balance. We are hoping for the best, while realizing the wisdom of being prepared for the worst. To-day or to-morrow may see settlement near at hand or achieved, or hope may have been again completely shattered. But if there were an immediate settlement, work could not well be started before next week. In a fortnight at least 9,600,000 tons of coal will have been lost; at 24s. 3d. per ton the miners will have lost wage payments amounting to between £11,000,000 and £12,000,000; a quarter of a million at least—perhaps many more—of other workers will have

been rendered idle through the absence of coal deliveries; the railways have lost a considerable revenue, which the taxpayers will have to bear; and the aggregate loss to the country is incalculable. All this because of the obduracy (this is a word favoured by the Miners' Federation for application to the Government) of the Federation in declining to be parties to a reference to an impartial tribunal of a 2s. per day wages claim!

"B.C.G.A."—Economy and Efficiency.

THE annual meeting of the British Commercial Gas Association in Sheffield last week was of an order which stamps progress upon the technical and commercial affairs of the gas industry. Through the Association, the industry pools the best of its commercial experiences; and the experience of one place is often an inspiration and direct motive force in another place. At this meeting the pool was greatly enlarged. The Association was received in Sheffield by the municipal authorities and the industries—including their good hosts the Gas Company—in a dignified and generous way, which disclosed an appropriate local recognition of the important and indispensable position occupied by the Association in the work and ambitions of the gas industry. As the National Gas Council is in the political life of the industry, so is the British Commercial Gas Association in its commercial life. Both are to-day integral parts of the industry, and they could not be torn out of it without doing inestimable damage.

The mass of contribution, both prepared and extempore, to the proceedings was so great that we cannot do more in later columns than give abstracts. But reading through the whole, the verdict must be that Progress, Economy, and Efficiency are impressed upon every component of the proceedings. We have this right from the start in the address of the President (Sir Robert Hadfield, Bart.) to the finish of the two interesting but crowded days. In the work that lies before the country, of restoring and increasing our production and national wealth, every industry, including the gas industry, must take its part; and Sir Robert acknowledges that no industry can contribute more to this, being the supplier of a labour-saving, easily handled, and efficient agent for heat and power, than that of gas supply. He of all men knows the value of gas in relation to the steel industry; he like most other manufacturers with the necessary experience is able to apportion to competing agents their place in contributing to the economy and efficiency of industry. With the judgment of disinterested experience the gas industry is quite content to abide. But Sir Robert strongly counsels the industry to supply gas constant in heat value, of an adequate pressure, and at a reasonable cost. "Reasonable cost" is a term that has to be estimated by the conditions of the times and in relation to other fuels. It is the aim of all wise gas men to supply gas of fairly constant heating value and of adequate pressure. To promote these conditions is one of the constructive principles of the Gas Regulation Act. It is, however, a matter for regret to learn from Mr. F. W. Goodenough's paper (published last week) that there are still to be found gas undertakings administered and managed in the style of the monopolistic days, when there were more men than now who considered that by supplying gas they were conferring a greater service upon the customer than the customer was on the undertaking by his patronage of gas. This method of administration and management must be completely stamped-out; and we hope the Gas Regulation Act and the controlling authorities will speedily bring such men (who fortunately are not representative of the men of the industry generally) to their senses, if they do not voluntarily see that their interest lies in good service in the broadest sense of the words.

Progress through the avenues of true economy and efficiency must begin at home; and then the higher will be the efficiency in service to those upon whom an industry depends for its well-being. This may be a commonplace; but it is one that obviously needs driving home in some quarters. Speaking generally of the gas industry, it may be said that in its manufacturing processes greater economy and higher efficiency have been gained, and are still being sought. The importance of this is marked in the contribution by Mr. D. Milne Watson, and is accentuated by fact in the papers by Mr. Thomas Goulden (the President of the Institution of Gas Engineers) and Prof. John W. Cobb, both of whom showed that the industry has increased, and is still increasing, the production of value per ton of coal used, which testifies progress and higher economy and efficiency, and thus coal conservation. Sir Dugald Clerk and Prof. Smithells will no doubt note, as probably Prof. Cobb has already done, that Mr. Goulden has a modest dig at the rule they applied in their coal conservation report, of placing all the heat expended in coal carbonization in gas-works upon the back of gas. Seeing that tar and coke—both having an economic fuel value together with gas—are results of the process of carbonization, it would appear that the debit of thermal loss should be charged *pro rata* between them. That is the view of Mr. Goulden.

We cannot, in this comment upon the proceedings, notice each paper or give details of the subject-matter. But in connection with prospective developments in gas manufacture, and so of coal conservation—thus reducing the cost of gas per heat unit in relation to other fuels—we see that Prof. Cobb is still optimistic regarding advance being made by the use of oxygen in gas production. He has no reason for departing from the view that he held at the June meeting of the Institution: That the cost of oxygen is almost certain to be very materially lessened in the near future, and that, as soon as this happens, a continuous process of gasifying coal with oxygen and steam is likely to be quite practicable, and to offer great economies not only in thermal efficiency (which it is calculated may be well over 90 p.ct.), but in the costs of constructing and operating plants. M. Zollikofer, Secretary of the Swiss Gas and Water Society, has done the gas industry of this country the honour of saying that it has regained its leadership in the matter of gas production; and its new conditions will give it head in this direction, and in retaining the leadership. M. Zollikofer, in the paper he read before the Swiss Society [*ante*, p. 30], referred to the Institution paper on this subject by Prof. Cobb and Mr. Hodsman, and suggested the cheap production of oxygen by the water-power generated electricity of Switzerland. In a letter to Prof. Cobb, M. Zollikofer intimates that the Swiss Society are making research to find out how far the proposed process is technically realizable. We hope they will have good success. At the same time, Prof. Cobb is of opinion that it would be a great pity if we in this country do not take steps to put ourselves in the position to reap advantage of any cheapening of oxygen as soon as it comes about, or even help to bring it about. We agree if the word "preparatory" is put before the word "steps."

"It is only by elimination that we shall economize," said Mr. W. J. Swain, F.R.I.B.A., in a paper in which he presented the details of how he has succeeded in saving, in the building of certain houses, some £105 by planning them on the all-gas principle. Column after column could be written on the above-quoted words for a text. "Elimination" of what? Elimination of all that is wasteful whether it be in house building, in gas manufacture, or in the utilization of it or any other fuel. The gas industry has a large field before it in which to eliminate waste—particularly in domestic heating; and the further it goes in this work, so much the greater will be national and human economy and efficiency. We heard of this from Mrs. Cloudesley Brereton and Dr. C. W. Saleeby, F.R.S. The work of displacing the coal fire will proceed unremittingly. It is one of the chief missions the gas industry has before it; and it is a mission which will increase the stability and progress of gas undertakings. And as the displacement proceeds, so will there be promoted the conservation of human energy and life, and so will there be advanced household economy. Householders are looking at the price of coal to-day and are comparing it with pre-war times. They are looking at the price of gas to-day, and are comparing it with pre-war times. But the higher efficiency of gas-heating in all forms over the coal fire, and the convenience of extinguishing the source of heat directly it is not wanted, render gas the cheaper per heat unit applied. The efficiency of gas appliances has, and is still being, advanced. We heard of this from various authors; and we heard of their applicability for all sorts of purposes from several sources—particularly in connection with the housing schemes. Our report shows a case unanswerable on scientific grounds. The same applies to the industrial applications of gas, and of coke for steam-raising. We must here quote just one statement from the paper by Dr. C. M. Walter: "In Birmingham, for the year ended "March 31, 1913, the total gas supplied amounted to "9,164,962,000 c.ft.; and the corresponding industrial heat-"ing load to 609,424,800 c.ft., or 6·66 p.ct. of the total out-"put. For the year ended March 31, 1919, the total gas "supplied for all purposes amounted to 11,984,263,000 c.ft.;

"the corresponding amount for industrial heating purposes "being 2,522,338,600 c.ft., or 21·04 p.ct. of the total out-"put." Progress both in economy and efficiency appears wherever we look in the proceedings at this remarkable meeting. There is one matter that is most important, and it is that gas undertakings must see (where they have not already done so) that the highest technical as well as commercial efficiency is found in the sales department. The Association is out to help in the promotion of this; it is part of their programme. The efficiency of the Association itself continues to grow; but increased costs are hampering movements. Such papers as the conference had from Mr. Goodenough and members of the executive staff—Mr. W. M. Mason and Mr. F. H. Holland—show that efficiency will not ebb, but if anything will strengthen in its flow.

The Path of Progress and the Trespassers.

The problems that the gas industry has to face to-day are of manifold order, some of permanent, others of temporary effect, but all of considerable magnitude and importance. Out of the stress and difficulties of war time, the gas industry (with all its contemporaries) has come only to be thrown into stress and difficulties of other order, and greatly harassing and perplexing. But in it all, the industry has been shaping its courses and combining its strength with the view to making the best possible of the new conditions which have grown up fast and powerful. Athwart the path of progress there stand those whose effort is reactionary, and who would fain bar progress, to the detriment of national and individual interests. Such effort has to be fought, and such barriers destroyed by counter effort and resistance. These conditions were fundamental in the thoughtfully constructed address which Mr. J. H. Canning delivered on Thursday last to the Wales and Monmouthshire Institution of Gas Engineers. He carefully traced the new developments in the political policy of the gas industry, as found in the establishment of the National Gas Council and the Federation of Gas Employers, which enable the industry to work in unison. These organizations had birth as part of the evolutionary process which applies as much to the gas industry as to all other parts of our national system. About the performance of the functions of these bodies the President had nothing to say but in the nature of encomium. It would be wrong to declare that all combined effort has worked out as the industry would have wished; it would be placing the mark of infallibility upon the organizations to assert there had been no errors; and it would be a claim to omnipotence to suggest that all conceived by the Council of a beneficial nature should have been materialized, in spite of opposition. Judgment must rest on actual results, and upon a consideration of what might have been of an adverse nature had these protective bodies not been brought into existence. There are some who censure and criticize on details, and give no credit for substance. They have as much to be thankful for as those who give credit for substance and effort, and grant that no man (nor any combination of men) can claim to be infallible. Among those who give credit, and they are of the overwhelming majority, is Mr. Canning; and among the monuments to the work of the National Gas Council he places the Gas Regulation Act, which, though it may not be without fault, owing to work outside the Council, is the best piece of constructive legislation for the industry that has ever been conferred upon it—looked at in its main parts, and in the extensive power and opportunity it confers. We do not wish to convey that the Act as it stands had its genesis, moulding, and final form given to it by the Council. The Board of Fuel Research, the Board of Trade, Parliament, and even opponents, were sources of influence and change; but throughout, the Council were themselves promoting improvement, and exercising influence in defence and moderation. From the birth of the Bill to the end of all avenues in which there could be contention and change, representatives of the Council were at hand looking after the interests of the whole industry.

The industry has the Act; and, as Mr. Canning points out, it is now for each undertaking to work out the problem of what has to be done under its own local conditions. The Board of Trade has eased these problems as much as possible; and there should not be any great difficulty in at any rate getting established upon the heat-unit basis—leaving other opportunities provided by the Act to receive subsequent attention. What we hope is only a transient shadow of uncertainty has been thrown across the path; but it is not at the present stage an impediment to progress. Impediment to progress can only come if the shadow develops into substance. In what he said in regard to this matter, Mr. Canning was voicing the unanimous feeling of the responsible men in the industry. "I certainly think," he said, "that a strong protest should be made, in the "interests of both gas undertakings and their customers, "against the action of scientific precisians who are endea-"vouring to secure the imposition of exacting clauses "restricting the percentage of inert constituents and carbon "monoxide, and at the same time imposing a minimum "methane content." The suggestion and the protest will find strong support in the gas industry. The President is right when he says that compliance with these requirements would increase very greatly the cost of producing thermal energy in the gaseous form, and would permanently hamper all progress and all initiative. The import of these words should be noted by the powers that be in these matters. To comply with the suggested obligations would (we say this emphatically) undo much of the good work the Gas Regulation Act is designed to accomplish, and would be altogether contrary to the spirit in which the Board of Fuel Research framed their report, which was that greater use should be made of the inherent strength of the gas industry to provide labour-saving fuel for the whole country, and to conserve as much as possible fuel and transport, and prevent fuel waste. These are objectives of great national advantage; and the increasing growth of the popularity of gas—despite the higher price which gas undertakings are hoping to diminish by more economical working under the powers of the new Act—shows that the public fully appreciate the service. Are the designs of the Act and the service of the whole community to be undermined by scientific excesses and finical non-essentials? This is the question that has to be answered. What is demanded must be found to have justification in experience and practicability, and must be weighed against public service and national economy. In order to be consistent, and to show that they are frankly disinterested, the same "scientific precisians" should ask, but they do not, that alternating electric current should not be allowed in any house or factory of a pressure higher than 50 volts. More was said in the address as to the uneconomical aspect of the proposals.

The difficulties of the gas industry are already more than sufficiently onerous; it is working for advance against great obstacles. This, too, must be taken into account in considering the question of new restrictions from the point of view of justification. Capital, plant, material, transport, labour—everything is dearer. Every new limiting obligation is an attack on economical working; and every limiting obligation that has been found unnecessary in the past is a gain to the reactionaries and obstructives. Among the difficulties of the industry is that of coal—price, supply, and quality. Just mark this. The President says the increase in the ash content of coal delivered to the Newport (Mon.) Gas Company, as compared with pre-war days, is 12·5 p.ct. Adding this useless material delivered and sold as coal to the decline in output in the South Wales coalfield compared with 1913 there is an actual falling-off of 26·5 p.ct. in the output of coal. There are many matters which all have some bearing upon the proposed unnecessary refinements, and which should be put before the tribunal who will be asked to pronounce in favour of creating new impediments to the progress of the gas industry in national service. They will learn (if not already well acquainted with the fact) that it is sometimes the way of supermen in a particular branch of work to climb pinnacles far above the practical levels of everyday life.

There was much else dealt with in the Presidential Address which will be found well worth reading. There are remarks as to the relations of capital and labour which we should like employees as well as employers to read. There were wise words as to education and training, and the suggestion that, in the highest interests both of the gas profession and the industry, it is time the whole of this most important question was set upon a sound basis. There was a word of praise to the Junior Associations whose influence for good is far above what is revealed by published record. Then came an expression of hope that the day will come when there will be at the University of Wales, a Chair of Gas Engineering and Fuel, and one or more scholarships open to the aspirants for technical positions in the gas industry. The policy of prudence and wisdom is exemplified throughout the address.

Sir Arthur Duckham Peeps into the Future of Carbonization.

Imagination, vision, candour, fact, and optimism are found blended in the paper that Sir Arthur Duckham read to the Institution of Petroleum Technologists last Tuesday evening. The development of home supplies of fuel oil is a national and economic necessity; and the petroleum technologists are anxious to know from the technicians of other interested industries what they think of the outlook in this regard. Sir Arthur was announced to deal with the subject of coal as a future source of oil-fuel supply; and no doubt many of those present had anticipated that he would have come along with a cut-and-dried scheme of how requirement is to be satisfied, and with supporting data. But they heard that this was one of the most problematical of current technical problems, and that the conceptions of the present have to be materialized and put to the test before it can be said how far our natural resources can contribute to the improvement of our economic state in this regard, and satisfy partially or wholly the national need. It is certain that the existing means of treating coal cannot do more than contribute to the meeting of demand; and there must be a complete revolution of all our carbonizing processes if anything more substantial is to be accomplished. That is where the author's combined imagination and technical ability came in, and inspired hope that the desire of largely filling our oil-fuel requirements by home production might be consummated by the exercise of brains and by evolution.

The matter is one for discussion, and the experimental development of ideas that possess promise of something really good resulting. We go a very long way with Sir Arthur in his views, but stop at the point where enlightenment and satisfaction must come from experiment. In dealing with our coal supplies, the natural order of things is that the maximum of utility should be derived from coal, because once it is destroyed it is irrecoverable; and to realize the maximum utility, the components of the coal must be separated. Coal, for instance, ought not to be utilized for the single purpose of raising heat or generating steam, except in the case of those coals that have no value for any other purpose. There is one qualification; and it is, if the result of completely gasifying the coal puts into convenient form such a large proportion of its thermal value that this will compensate for the destruction of its other valuable contents, then there is justification. Coal is a base that is creative of much else than heat, if properly treated; and though, in so treating it, there may be loss of efficiency in some direction—such as in the generation of steam—the loss of efficiency may be insignificant when set against the loss that would be occasioned by the destruction of other products. In other words, the value of the difference in efficiency has to be measured against the loss by the destruction of valuable products—among them oil fuel.

Oil fuel will be in big demand for marine and locomotive purposes; but we dare not turn-off completely to this fuel for such purposes until the supply is sufficiently assured, as otherwise we should one bad day find ourselves boxed-up without the means of complying with the demand. The author looks about him prospectively. It is his belief that the industrial future of this country lies in the conversion of coal at the pit's mouth into liquid and gaseous fuel. Liquid fuel will be the recognized means for providing energy for all transport both on land and sea, except electrical transport for congested areas, while gaseous fuel will be used for the great majority of heating purposes, and for the generation of electricity by means of steam plants and engines. We believe this, with one exception, is a very fair forecast of the future in these respects. The exception is the carbonization proposal at the pit's head. If nothing but gas, oil fuel, and ammonia were wanted in the country, we might be more friendly to the hoary-headed proposal for pit-head carbonization. Nature did its work very badly and without a thought for the future when it created a complex substance like coal, and packed into it so much utility ready for easy transport, if all its work was to be undone by separating the components just above the point of their creation. It is not likely that all suitable coal will be completely gasified in the time to come. Coke will still be wanted for certain local purposes, so will tar, and so will sulphate of ammonia. When the transport of easily carried coal is dropped, and carbonization at the pit head is the vogue, then gas will have to be distributed thence by enormous networks of high-pressure mains, coke more bulky than coal (and so more costly for transport relative to intrinsic value) will have to be carried by rail, mechanical road vehicles, or boat from the pits, tar will have to be distributed in casks throughout the country for road and other local purposes, industries will get concentrated in the neighbourhood of the collieries, and the remainder of the country will be the poorer for the removal and concentration. We fear that, from all this varied transportation and industrial concentration, the balance of economic advantage of pit-head carbonization, as compared with local carbonization in suitable distribution areas, would be found to be altogether against the country.

However, that has not much to do with the main problem of enhanced production of oil fuel; it is only incidental to it. Sir Arthur surveys present and proposed carbonizing processes. He sees the prospect of great developments in the gas industry now that restrictions are being removed or relaxed. He does not, however, think that horizontal retorts will do anything to supplement the provision of tar fuel oils; but he does look to continuous carbonization in vertical retorts making further contribution because of the temperature conditions, and the protection by steaming of the evolved hydrocarbons, which increases the make of gas and lighter tar oils. There is one thing in this connection that we have heard from Sir Arthur on more than one occasion; and it is that he does not believe, though the continuous vertical retort constitutes, in his opinion, the best gas-works practice of to-day, that it represents finality. This is the proper spirit. The technical men of the coking industry will be interested in the part of the picture which predicts the doom of their industry. The author does not discern any prospect of bye-product ovens contributing tar oils to meet national needs; and he is of opinion that time will see gas used for smelting iron ores, and not coke. This will mean the disappearance of coke-ovens. Gas-producers are altogether out of court so far as fuel oils are concerned, Low-temperature carbonization is in better case. It gives tar oils in quantity and quality, and in the best form for utilization and treatment; and the gas contains considerable quantities of saturated hydrocarbons which, extracted, would form a very valuable supply of light fuel oils. There are problems yet unsolved, but in Sir Arthur's opinion not unsolvable, in connection with low-temperature carbonization. There is something more. The system has yet to be proved commercially; and until it is one cannot say whether or not the fuel and light oils would not be produced at an uncommercial price. Then complete gasification (though a valuable process for small gas-works, and auxiliary for larger works under the heat-unit system of gas supply) will not yield tar oils.

The survey of present carbonization processes will not have inspired much hope in the hearts of the petroleum technologists of any considerable augmentation of assistance from them. The author, however, did not leave them without hope that there would be developments. To have an ideal signifies the probability of an endeavour to attain it. Sir Arthur has an ideal. The future coal carbonization system must be one that will supply heat units in gaseous form, tar oils in quantity, and ammonia. The neglect of the tar oils and the ammonia is regarded by not a few technicians as the point of failure in complete gasification as at present practised. The ideal plant must be economical in first cost, and labour charges low; and the temperatures must be such that the minimum cracking of the hydrocarbons will take place. The gas must be afterwards stripped of its saturated hydrocarbons, and supplied to consumers constant both in heat value and specific gravity. The plant pictured is one or more vertical retorts superimposed on a water-gas producer; the coal being fully converted into coke before entering the producer. The plant (as will be seen from the paper) would be fitted in a manner to achieve the utmost economy, and realize the highest possible temperature efficiency. Through such a plant, if materialized, the fuel-oil position would become much easier, as greatly increased supplies would be forthcoming; and, as far as Sir Arthur can calculate, gas would be distributed to consumers at one-and-a-half times to twice the cost per heat unit as fuel supplied in solid form. As the efficiency of gas heating is so largely in excess of that of coal heating, the result would be (assuming the correctness of the calculation) a saving to the consumer, without taking into account all the saving in labour and inconvenience associated with solid fuel, whether in the home or the factory. There is the ideal. It is only

an ideal—at present. Will it mature? Perhaps in time we may hear from the author that it has done so. But at the moment the increase of the contribution of coal carbonization to the fuel-oil supplies of the country depends upon the extension of the gas business and the type of plant utilized to satisfy the greater demand, or replace degenerated plant now in existence.

Methane and Explosiveness.

For gas men an interesting part of a report by the Research Sub-Committee of the Miners' Lamp Committee, appointed by the Home Secretary to inquire into and report upon the improvements in miners' lamps, is that referring to flame propagation in methane and air mixtures. The investigation takes our thoughts back to Prof. Bone's Cantor Lectures in March-April of last year, and to the more recent proposals of the Fuel Economy Committee of the British Association (whose voice Prof. Bone supplies) that the minimum methane content in town gas should be 20 p.ct., in view of the lessened rate of explosibility than when the methane content is at a lower percentage. Gas will explode under given conditions whatever may be the methane content; but the percentage affects the speed of the flame. When Prof. Bone delivered his Cantor Lectures, he did not seem very clear as to what would happen with gas containing low percentages of methane. Whether he improved his knowledge subsequently before alighting upon the 20 p.ct. as the minimum for town gas, we are not aware; but the miners' lamp investigation affords some enlightenment on the point.

The Sub-Committee made measurements of the speed of the uniform movement of flame in mixtures of methane and air in a horizontal glass tube 5 cm. in diameter, for the purpose of comparing the explosiveness of the mixtures. The results were:

Methane.	Speed of Flame. Per Second.	Methane.	Speed of Flame. Per Second.
P.ct.	Cm.	P.ct.	Cm.
5·40	30·0	9·80	93·5
5·85	33·5	10·00	93·5
6·75	45·0	10·60	91 0
7·10	50·0	11·00	83·5
7·70	63·5	11·50	70·0
8·35	75·0	12·10	51·5
8·80	83·5	12 65	39·0
9·10	87·5	13·05	34·0
9·45	91·5	13·80	30·5
9·60	92·5	14·30	30·0

These figures and the accompanying curves show clearly that the fastest speeds of uniform movement of flames are obtained with mixtures containing between 9·5 and 10 p.ct. of methane; and that the speeds rapidly decrease as the percentage of methane decreases or increases on either side of this range. In fact, the data disclose that with the mixture containing 5·4 p.ct. of methane the speed of flame is exactly the same as it is with the mixture containing 14·3 p.ct. This is extremely interesting.

It is, of course, well known to students of this subject that the speed of propagation of flame in mixtures of coal gas and air may be considerably faster than in any mixture of methane and air; and that a reduction in the proportion of paraffins which coal gas contains—such as is usually accompanied by an increase in the proportion of hydrogen when (say) water gas is employed to dilute the coal gas—enables a much higher speed of flame to be attained than can be given by mixtures of methane and air. Even with gas produced solely by the carbonization of coal at normal retort temperatures, the speed of propagation of flame attainable is more than double that possible in mixtures of methane and air. This increase in speed has practical benefit in some uses. No case has yet been proved for prescribing a minimum of methane in town gas—in fact, such a limitation would be an economic disadvantage. There has been considerable experience with low-grade gas in industrial operations and with mixtures of coal and water gas for general town purposes and it is idle to suggest that the experience has shown any increased danger in practical service considering the extension of use. If there is any accidental escape of gas, the smell is the best possible protection, and the introduction of an igniting medium is an essential. Increased laboratory research should make for progress, not retardation. We hear a good deal about applied science; science can also be misapplied.

The First Order Applications.

According to the minutes (published in our columns to-day) of annual meetings of some of the District Executive Boards of the National Gas Council, a selection has been made of the undertakings whose applications for Orders under the Gas Regulations Act are to be placed in the first instance before the Board of Trade. It was suggested four undertakings should be nominated by each district; but in the case of the South-Western District, it was considered that three cases would suffice. The South Wales District Board have passed a resolution recommending the National Gas Council Central Executive Board to consider carefully the proposition of devising some method for pooling the extra expenses that will be incurred by the selected cases put forward by the Executive. The recommendation is made on the ground that these will be fighting issues which are of common interest to the whole of the undertakings of the country. Another interesting point has been settled with the authorities. It is understood that gas undertakings issuing half-yearly accounts, and obtaining an Order which comes into operation before June 30 next, will be able to pay any revised dividend that may be the outcome of the Order for the half year. In the case of those undertakings with accounts made up annually, any Order which comes into operation before Dec. 31, 1921, will entitle them to pay any increased dividend that may be the outcome of the Order in respect of the whole year. This will obviate any undue rush of applications.

Recording Calorimeter.

It was stated at the annual meeting of the South-Western District Executive Board of the National Gas Council that a new type of recording calorimeter is under consideration, which will have attached to it an apparatus for measuring the pressure.

The Strike and the Weather.

The weather was grossly unfavourable to the community and to light and heat suppliers last week. The temperature fell considerably; and people, in their efforts to comply with the Government request to save fuel in view of the miners' strike, sat indoors and shivered, until physical endurance became exhausted, and then many succumbed to the desire for a little additional heat. Fogs, too, made light a necessity for a greater number of hours than would otherwise have been the case. The putting of the clock back one hour on Sunday night, thus ending the (this year) misnamed "summer-time," has transferred some of the morning lighting to the evening—so making the claims heavier at the busy part of the day for both gas and electricity suppliers.

Allowances for Wear and Tear.

Crumbs of comfort as well as slices (of which there are not many to-day) are acceptable in these times. It will be remembered that a Sub-Committee of the Gas Companies' Protection Association some time ago satisfied the Inland Revenue Commissioners that, in view of the ravages of war time and the flight of costs, the allowance for wear and tear depreciation of 3 p.ct. on gasholders should go up by 50 p.ct., making it 4½ p.ct., and the 10 p.ct. on meters and stoves should be raised by an equal percentage to 15 p.ct. The increase was allowed for two years. It was the pleasure of Mr. T. H. Hazell, of Newport, to announce, at the meeting of the Welsh Institution last week, that the authorities, through the representations of the same Sub-Committee, have consented to the additional 50 p.ct. allowance continuing for another year. It seems to us that a very good case could now be made out for the current allowance becoming the permanent one.

The Tale of a Gas-Geyser.

There were naturally many references to gas selling at the meeting of the British Commercial Gas Association last week. It is highly important that the salesman and also the fitter, or the official who arranges for the fitting, should be technically well up in his work. The ideal in every job is to give satisfaction to the user, and then all will be well. While the "B.C.G.A." were conferring, we heard in another place of an electrician who had a gas-geyser fitted in his bath-room, but the ventilating-flue was of such a character that, when the wind was in a certain direction and the geyser was set going, the flames were invariably extinguished. This need not have been. There was no complaint as to the efficiency of the geyser when the wind was in a quarter where it did not molest the flames, and the electrician was then

quite satisfied with it. Because of the extinguishing trouble, he decided to have an electric geyser fitted. We were told in confidence what the electrician's wife said about the new possession; but, being in confidence and not complimentary, it must not be repeated. We may say this, however, that she preferred the active work of the gas-geyser when there was no interference with it on the part of the wind. The moral is that work should be done, or be designed, by men who are qualified to guard properly against such happenings.

Gas Coke Exports and Values.

We are grateful to the Board of Trade. On various occasions it has been suggested in the "JOURNAL" that it would be an interesting thing to have the gas coke exported separated from the metallurgical coke. In the last returns issued, this has been done. In the month of September, the quantity of gas coke exported was 74,133 tons; and of "other sorts" 44,843 tons—together 118,976 tons. This last-named total compares with 150,096 tons in 1919, and 125,357 tons in 1913. In the nine months ending September, 632,226 tons of gas coke were exported, and 806,129 tons of other sorts—together 1,438,355 tons. For the corresponding period of 1919, the total coke exported was 1,012,504 tons; and for that of 1913, 838,055 tons. While the quantity of coal exported has been slipping downwards, the tonnage of coke has been pressing upwards. The values given in the returns are very interesting. The 74,133 tons of gas coke exported last month are valued at £609,800, or a fraction of a penny over £8 4s. 6d. per ton. The 44,843 tons of "other sorts" are valued at £314,983, or a fraction of a penny under £7 0s. 6d. per ton. The 632,226 tons of gas coke exported during the nine months are valued at £3,859,934, or a fraction of a penny more than £6 2s. 1d. per ton. The 806,129 tons of "other sorts" are valued at £4,453,210, or a fraction of a penny short of £5 10s. 6d. per ton. The figures per ton for gas coke are enough to make those gas coke producers envious whose markets are confined to home purchasers. In view of the coal strike, however, coke has for the time being been placed on the same footing as coal as regards conservation and distribution.

Coal Shipments.

Coal shipments in September only amounted to 1,475,623 tons, as compared with 2,677,189 tons during September, 1919, and 6,197,180 tons in the same month of 1913. In the nine months ending September last, the shipments amounted to 19,851,555 tons; in the corresponding period of 1919, to 26,838,612 tons; and in that of 1913, to 54,517,788 tons. This is confirmation of the heavy decline about which so much has been heard, and which is due to output conditions, and requirements at home.

Gas Oil Imports.

According to the Board of Trade returns, the total import of gas oil during the past nine months was 43,290,332 gallons, compared with 17,529,518 gallons in the corresponding period of 1919. This is a big increase. For motor spirit the comparative figures are 151,385,933 gallons and 155,705,992 gallons; so that there was in this direction a decline which may be described as substantial, having in view the growing demand. Fuel oil, however, showed a big stride upwards—246,681,404 gallons, compared with 185,978,437 gallons. The total oil imports in the nine months were 640,287,818 gallons, as compared with 529,139,268 gallons.

Housing Schemes.

Gas engineers and others who are desirous of obtaining authentic information as to the savings to be effected in the costs of building houses by adopting "all-gas" for heating, and so enabling a very large departure to be made from the plans applying to "all-coal" heated houses, will find a concrete example in the proceedings at the annual meeting of the "B.C.G.A." last week. The figures given by Mr. W. J. Swain regarding savings and costs at the Garden Village of New Earswick are actual and remarkable, and well worthy careful attention and use. A paper that Mr. James Robb read at the meeting of the Welsh Institution of Gas Engineers last Thursday gives actual costs as to the pipe and fitting work carried out at Hardwick Village, Chepstow. An abstract of the paper and of the discussion is published on a later page.

NATIONAL GAS COUNCIL DISTRICT EXECUTIVE BOARD MEETINGS.

THROUGH the courtesy of the various Secretaries, we are able to give an indication of what transpired at recent annual meetings of District Executive Boards of the National Gas Council.

SOUTH-WESTERN AREA.

The meeting of the District Executive Board for the South-Western Area took place at the offices of the Exeter Gas Company on the 15th inst., when the Management Committee were re-elected for next year. Mr. G. Hardy Harris was re-elected Chairman, and Mr. Percy S. Hoyte Vice-Chairman; Mr. James Armstrong, of Ilfracombe, being appointed Secretary. Mr. S. J. Ingram was re-elected representative on the Central Executive Board.

A letter was read from headquarters concerning the procedure which had been adopted with regard to applications for Orders under the Gas Regulation Act. Each district was asked to nominate not more than four cases to place before the Board of Trade. As soon as the selection had been made, the District Secretaries would communicate the names of the undertakings in question to the Head Office of the Council; and representatives from the undertakings would be called to a meeting in London on the 28th inst., after which the applications would be sent in to the Board of Trade on behalf of the selected undertakings. Undertakings not selected were particularly requested to withhold sending in applications until a week later—*i.e.*, Nov. 6. It is understood, the letter said, that, in respect of undertakings whose accounts are made up half yearly, any Order which comes into operation before June 30, 1921, will entitle the undertaking to pay any revised dividend that may be the outcome of the Order for that half year; and that, in the case of those undertakings whose accounts are made up annually, any Order which comes into operation before Dec. 31, 1921, will entitle the undertaking to pay any increased dividend that may be the outcome of the Order in respect of the whole of the year 1921. It was resolved that Plymouth, Torquay, and Falmouth be the selected undertakings for the district; and that the district should recommend to the National Gas Council that any additional expenses incurred in connection with the selected cases should be borne by the industry as a whole.

Mr. Ogilvie, the Assistant Manager of the National Gas Council, stated that a new type of calorimeter was under consideration, which would have attached to it apparatus for registering the pressure.

MIDLAND DISTRICT.

The Midland District Board met at the Grand Hotel, Birmingham, last Thursday.

The Secretary (Mr. C. M. D. Belton) read a letter from the National Gas Council reporting the progress which had been made with the investigations regarding the standardization of cookers. The annual report of the Management Committee, which was adopted, contained the following reference to this matter: The question of the standardization of cookers has received close attention by the Management Committee, who co-opted Mr. R. J. Rogers, of the Birmingham Gas Department, and Mr. H. Clark, of the Derby Gas Light and Coke Company, for the purpose of investigating the schedule of particulars received from the undertakings, and drafting a report embodying the requirements of the district. This entailed a considerable amount of labour; but the Committee are hopeful that the National Gas Council will push forward with the scheme, now that it has been carried so far.

Mr. Ogilvie referred to various points in connection with the Gas Regulation Act; and four representative undertakings were selected, whose cases should be put forward by the National Gas Council.

The Management Committee were re-elected, with the exception that Mr. H. Davies, of Chesterfield, was appointed in place of Mr. George Clark (resigned). Mr. Hubert Pooley was elected Chairman, and Mr. J. Paterson Vice-Chairman for the ensuing year. Thereupon Mr. George Stevenson was elected to the vacancy on the Management Committee caused by Mr. Paterson being made Vice-President. Mr. Belton was re-elected Hon. Secretary. Mr. H. Davies was appointed to the vacancy among representatives on the Central Executive Board; and Mr. A. W. Smith (retiring by rotation) was re-elected.

The Secretary read a letter from the National Gas Council with regard to certain restrictions that a railway company have been endeavouring to impose upon a gas undertaking, referring to the adjustment of the pressure of gas in relation to its calorific value. Members were urged to refuse absolutely to agree to such a stipulation.

SOUTH WALES AREA.

The annual meeting of the District Executive Board for South Wales was held in Cardiff on the 14th inst.

The Secretary (Mr. W. Clark Jackson) read the annual report, and stated that five new members had joined this year.

The Management Committee were re-elected. Mr. George Clarry was re-appointed Chairman, and Mr. J. E. Kenshole Vice-Chairman, of the Board. Mr. George Clarry was re-elected one

of the representatives on the Central Executive Board; and Mr. Jackson was re-appointed Secretary for the ensuing year.

It was agreed to send the following resolution forward: "That the District Executive Board recommend the National Gas Council Executive carefully to consider the proposition of devising some method for pooling the extra expenses incurred by the selected cases to be put forward to the Board of Trade by the National Executive, as these will be fighting issues which are of common interest to the whole of the undertakings in the country."

FEDERATION OF GAS EMPLOYERS.

South-Western District Committee.

AT the annual meeting of the South-Western District Committee of the Federation of Gas Employers, held at Exeter on the 15th inst.—Mr. W. N. Westlake in the chair—much regret was expressed at the loss of the valuable services as Chairman of Sir Percy K. Stothert, K.B.E.

Mr. J. H. Ellis was elected Chairman, Mr. Percy S. Hoyte Vice-Chairman, and Mr. J. Taylor, Gas-Works, Weston-super-Mare, Hon. Secretary. The following appointments were also made: Management Committee: Messrs. R. Beynon, J. B. Cattle, F. O. O. Chubb, J. Hughes Cornish, C. G. Dawson, W. E. Dean, G. Fenwick, S. J. Ingram, J. E. Norman, J.P., R. Robertson, W. N. Westlake, J. Wesley Whimster. Representatives on the Central Committee: Mr. R. Robertson (re-elected) and J. H. Ellis (elected for the unexpired portion of Sir Percy K. Stothert's term). Representatives on the South-Western Regional Council: Mr. J. H. Ellis and Mr. J. Wesley Whimster (in place of Sir P. K. Stothert and Mr. H. H. Hoare). Representative on the Emergency Committee of the Central Executive: Mr. J. H. Ellis.

SOUTH WALES DISTRICT COMMITTEE.

At the annual meeting of the Committee in Cardiff, on the 14th inst., Alderman Morgan was reappointed Chairman; Mr. J. Herbert Canning, Vice-Chairman, and Mr. Octavius Thomas, Gas Offices, Pentre, Rhondda, Hon. Secretary.

Other elections were: Management Committee: Alderman Morgan, Councillor D. Davies, Messrs. H. Barker, A. H. Brookman, J. H. Canning, T. E. Franklin, W. H. Johns, J. E. Kenshole, T. C. Kirk, A. T. Kyle, L. Murray, and E. H. Swain. Alderman Morgan was re-elected a member of the Central Committee of the Federation for the ensuing four years.

The Oil-Shale Industry.

Mr. Victor C. Alderson, the President of the Colorado School of Mines, has been addressing the Independent Oil Men's Association at Denver on the methods which are employed in the oil-shale industry on this side, and basing upon them suggestions for the utilization of American shales. In Scotland, he says, the problem is the margin between the cost of production and the selling price; but in England the question is quite a different one, for though there are extensive deposits of rich oil-shale, unfortunately they contain an excess of sulphur, making the resulting oil virtually worthless for any purpose except for fuel. Thus the great problem before the oil-shale industry in England is a method of removing this sulphur—from 6 to 8 p.ct. or more—from the shale during the process of retorting, or from the crude oil, without spoiling the oil. Until this technical problem is solved, the oil-shale deposits of England are commercially worthless. During the war the British Admiralty raised the allowable limit of sulphur in oil to 3 p.ct., but paid a low price for any above 2 p.ct. When the solution of the sulphur problem arrives—as it probably will some day—great quantities of oil-shale in the Kimmeridge formation, now commercially valueless, will become a source of great wealth to the British Empire, and of economic importance in furnishing an additional domestic supply of oil. Fortunately for the oil-shale industry in the United States, sulphur has not yet been found in quantity sufficient to be detrimental to the oil produced; and there is also little or no sulphur in the Scottish shale. The present Scottish methods are well adapted to the shale treated; but they should not be slavishly adopted in other countries, unless conditions are identical. Where sulphur does not occur to an objectionable extent, the serious problem is the design of an efficient retort. Many retorts are in process of development; and just now "it is virtually impossible for anyone (except the inventor himself) to select the best." However, in Mr. Alderson's opinion, the successful retort will be one of three types—the present Scotch type, where local conditions are identical with those in Scotland; a vertical, modified Scotch type, adapted to shale rich in oil, but low in nitrogen content; or a horizontal type which will be based on correct scientific principles, and be absolutely new. It is not impossible that successful retorts will result of all three types.

A pleasant ceremony was performed at the Gas Street works of the Bolton Corporation Gas Department, on Friday last, when Mr. J. W. Smith, B.Sc. (the Gas Engineer and Manager), presented a handsome leather suit case and wallet to Mr. ERNEST HARDIKER, who is relinquishing the position of Works Manager, having obtained the post of Deputy Engineer and Manager to the Smethwick Corporation Gas Department.

ELECTRICITY SUPPLY MEMORANDA.

AT last a real move is being made to abolish the appellation of "half watt" for the latest form of incandescent electric lamp. It was the parents of this vision destroyer who gave the name to the lamp; and it appeared to be such a useful trade-promoting description that it was accepted with avidity and used by the electricity industry until the truth came out that the lamp—especially the lower candle-power ones—did not give an efficiency of 1 candle per ½ watt; and for very shame at having been made the instruments of a deception, the more honest of electrical men dissociated themselves from its further use, and left the title to be applied only by those electricals who have peculiarly elastic consciences. We called attention to the divergence between performance and representation soon after the lamp originally came on to the market; and this was done not on mere hypothesis, but on actual measurement of the current used and the candle power realized. Decency and honesty have invoked the aid of the Associated Lamp Makers to put a stop to the longer use of the misnomer; and they have agreed to do so, having a further incitant in the fact that vacuum lamps with a spiral form of filament, and which look like the misnamed "half watts" (especially when overrun), have come on to the market, and have been sold as "gasfilled" ones at a little less money, but more than the price of vacuum lamps. "Gasfilled" (as a single word) is to be the new name. It is not an ingenious description; it only discriminates between the vacuum and the inert-gas filled bulb lamps. Many people have been using the term for a long time rather than be parties to the old misdescription. The dropping of the term "half watt" is accepted by our contemporaries as being right, though hitherto we have not noticed any particular warmth on their part in condemning the scandalous piece of deception. But their moral susceptibilities, jogged by the decision of the Associated Lamp Makers, have been awakened. The "Electrical Review" says it is imperatively necessary that electrical apparatus of all kinds should be described in terms corresponding strictly to their true merits. The "Electrical Times" trusts that the new name will drive the term "half watt" out of the market. Still "Meteor" is not happy. He does not like the title "gasfilled." The use of the word "gas" is unfortunate; it reminds him too much of that "execrable entity," which happens to be so popular, so useful, and (relatively to electricity) so cheap for many purposes. He would like the Associated Lamp Makers to try again; and he suggests that perhaps, if they offered a prize for a suitable name, some happy idea might be forthcoming. Why not the "Optic-Destroyer" lamp?

Renaming the "Half Watt."

The Signs of Envy and Malice.

Some of the electrical papers find consolation in deriding gas. It does no harm; and the gas industry can afford to treat with contempt their exercises in this direction. There is the example in "Meteor's" "execrable entity." "Electrical Industries," too, cannot hide its envy and malice in some comments which it makes on the meeting of the British Commercial Gas Association. It finds that gas needs "a tremendous lot of boosting;" and it adds: The only business-like comparison between electricity and gas is that "if an industry which is selling something so objectionable in its qualities and so limited in its powers as gas, can find profit in combined national and local publicity, the electrical industry will obtain immeasurably better results from a similar effort on the same scale. There is something heroic about the attempt to build up a popular movement in favour of gas." That is as fatuous as it is strange for one who may be supposed to be a close observer of the movements of the times. The measure of the objectionable quality of anything may be taken to be in inverse ratio to the extent of its popularity; and the business done in gas has been, and is, expanding at a rate to put into the shade the rate of expansion that obtained before electricity came into the field. We really do not know what is meant by "so limited in its powers as gas." Our critic may perhaps have been making his examination through a telescope turned the wrong way about. At 10d. per therm we have a price that compares well with electric lighting by its very latest methods, and beats it out and out in the quality of light; for heating we place in the hands of the consumer a potential heating value equal to that given by 29 units of electricity; and for continuous running on good loads, gas for power knocks electricity out of the field on the score of economy. Yet "there is really something heroic in the attempt to build up a popular movement in favour of gas." That is thin, and the voice squeaky. The popular movement in favour of gas is here in splendid flow. The educational work of the British Commercial Gas Association is supplementing experience in raising the level of the flow. There is nothing heroic in such propaganda.

Effective Heating Value and Its Cost.

The advent of the therm disturbs and haunts "Meteor" of the "Electrical Times." He cannot leave it alone. It crops up nearly every week in his notes; and he simply treats it as a subject for ridicule, though, inasmuch as the purposes for which gas is used are served by its thermal value, the sanest way of selling it is on the basis of the heat units

put into the possession of the buyer. We are sorry to see the certificates that "Meteor" himself gives as to the sad decline of his philosophy. Here is an example: "Our readers are aware that gross calorific value, which is what the therm is measured by, is altogether a different thing from effective heating value as measured by the cooking or heating work done. But the public are apt to swallow anything sent out in print which is above their heads, and is issued with a show of authority. They find out the real truth in time by experience, and most of them know how cheap their electric light is, in spite of former propaganda." "Meteor" starts off on cooking and heating, and ends up on electric light, though between the application of electricity to cooking and heating and to electric lighting there is little relationship. We will take him on his own ground of "effective heating value." Pricing a therm (100,000 B.Th.U.) at 10d., and a unit of electricity (3420 B.Th.U.) at 2d. for cooking and heating, twopence will purchase the gas way 20,000 B.Th.U., and put that into the possession of the user, compared with the 3420 B.Th.U. of the unit of electricity. It is easy to get by the modern gas-fire an effective heating value of 75 p.ct.; and 75 p.ct. of 20,000 B.Th.U. is 15,000 B.Th.U., compared with 3420 B.Th.U., if one has the audacity to claim 100 p.ct. efficiency for the electric-radiator. Boiling being the largest operation in cooking, we will take it for another comparison. The efficiency of the ordinary gas boiling-ring may be taken at 50 p.ct., though there are rings which will develop 60 p.ct. and more efficiency. The 50 p.ct. efficiency means an effective heating value of 10,000 B.Th.U. for gas, and where 60 p.ct. is obtained 12,000 B.Th.U. For an electric boiling-plate, 40 p.ct. effective heating value is an ordinary approximate figure; and the effective heating result is described by 1370 B.Th.U. Never did "Meteor" write truer words: The public "find out the real truth in time by experience." Experience is the strongest opponent with which the Electrical Development Association has to contend.

The Deception of the "Gasfilled" Lamp.

In a letter noticed in the "Memoranda" for Sept. 15, "E. W. D." exposed the then called half-watt lamp [now the "gas-filled"], and showed that, in the matter of efficiency in relation to cost, it was no better than the metallic filament lamp. "E. W. D." has revealed himself in an article in the "Manchester Guardian," signed "E. W. Dorey." He enlarges upon what he previously said. The point is reiterated that the filament of the gas-filled lamp being so much more concentrated than that of the metal filament lamp gives one immediately the impression that the one is much more powerful than the other; whereas the 60-watt gas-filled lamp gives only 20 p.ct. more light than the 60-watt metallic filament lamp. Utilizing the data published by makers, Mr. Dorey has compiled a number of tables, which give a comparison of efficiencies of the metal filament and gas-filled lamps respectively. For convenience 200 to 250 volt lamps are taken:

Metal Filament.			Gas-Filled (Half-Watt) Type.		
Watts.	Lumens.	Lumens per Watt.	Watts.	Lumens.	Lumens per Watt.
20	147	7·35	60	620	10·26
30	229	7·63	100	1,200	12·0
40	330	8·25	150	1,800	12·0
60	515	8·60	200	2,500	12·5
			300	4,200	14·0
			500	7,300	14·6
			1000	16,500	16·5
			1500	26,000	17·33

It will be seen that, whereas in the case of the metal filament lamps there is a difference of 17 p.ct. only over the range of sizes, the difference in the case of the gas-filled lamps is no less than 69 p.ct. This emphasizes more than anything the fallacy of terming the whole range "half-watt," giving the impression of equal efficiency.

Comparative Costs.

Another comparison between a 200-volt 60-watt gasfilled and a 60-watt metallic filament lamp is this:

Type.	Watts.	Lumens.	Units per 1000 Hrs.	Current Cost at per Unit. 7d.	2d.
Metal filament.	60	515	60	420d.	120d.
Gasfilled	60	620	60	420d.	120d.

	Price. Watt.	List.	80 p.ct. of List.
Metal filament	60	42d.	33·5d.
Gasfilled	60	90d.	72·0d.

It is well known in practice that the life of the gasfilled lamp is much lower than that of the metal-filament lamp; and it is reasonable to assume the figures as 700 and 1000 hours respectively. To get at a true comparison of cost it is necessary to arrive at the lumen per penny (of total cost) efficiency of the respective lamps. This is worked out to 1000 hours' use:

Type.	Lumens.	Current at 7d.	Lamp.	Total.	Lumens per Penny.
Metallic filament 60 watts.	515	420d.	42d.	462d.	1·115
Gasfilled 60 watts	620	420d.	$(90d. \times \frac{*10}{7})$	549d.	1·13
			= 129d.		

[* Ratio of burning hours.]

It will be seen, therefore, that for all practical purposes the lumen efficiency per penny of cost at 7d. per unit is the same for both lamps; and if current is obtainable at 6¼d. per unit or less, the balance is in favour of the metal filament lamp. The industrial user is on a very different basis from the domestic user, in that it is usual for supply for lighting up to 10 p.ct. and even 20 p.ct. of the total consumption to be obtained at the power rates. Further, being a large purchaser of lamps, special discounts are obtainable; and it is safe to assume 2d. per unit and 80 p.ct. of list price as basic conditions at present obtaining. Mr. Dorey gives us the following calculation per 1000 hours' use:

Type.	Lumens.	Current at 2d.	Lamp.	Total.	Lumens per Penny.
Metallic filament 60 watts.	515	120d.	33·5d.	153·5d.	3·35
Gasfilled 60 watts	620	120d.	$(72d. \times \frac{10}{7})$	223·0d.	2·78
			= 103d.		

Being a difference in favour of the metal filament lamp of more than 20 p.ct. on a lumen per penny efficiency basis. In conclusion, Mr. Dorey says it will be seen that, speaking generally, the application of the low wattage gasfilled lamps to industrial purpurposes is not sound commercially. Indiscriminate use of the gasfilled lamp without examining its efficiency and its characteristics is not only prejudicial to the interests of the electric lighting industry but a costly experiment on the part of the user.

Heavy Increase on the Low-Priced Units.

It will be remembered that some consternation was caused in the electricity supply industry generally, and in the Sheffield Electricity Department particularly, by the Sheffield City Council a few months ago passing a resolution which would, if given effect to, have equalized the charges for lighting and power. The resistance that was offered to this, and the argument advanced, gave the Council reason to pause; and they remitted the matter to a Special Committee to ascertain whether or not the Council had erred, or whether the price-raising proposals of the Electricity Supply Committee should be carried out in order to secure an increase of revenue. This the Special Committee find is imperative; and so they propose that on all units charged at over 2d. per unit, the increase should be 50 p.ct., instead of 40 p.ct.; on all units charged at 2d. or under, 150 p.ct., instead of 105 p.ct.; and to the tramways and motor department, 75 p.ct., instead of 50 p.ct. This is only a sort of interim proposal, as the Committee want to go more fully into the whole matter before making recommendations of a permanent character.

SIXTY YEARS AGO.

[From the "Journal" for October, 1860.]

The Vocation of Journalism.—Some of the London journals continue an insensate and ignorant outcry against gas companies, and complain of the dimness of light in the street, in shops, and in places of public amusement. These complaints come very inopportunely at the time the St. James's Vestry are endeavouring to prevent the Chartered Company from giving a better supply of gas to their customers. But it is the vocation of journalism to keep-up excitement, no matter by what means; and in pursuance of this object, discretion is oft-times disregarded, and complete ignorance of facts is no obstacle. A ridiculous article of this kind appeared in a recent number of the "Civil Service Gazette," so utterly wanting in common sense, and so blindly ignorant of the subject, that it is quite laughable from its folly and absurdity. As an example of the manner in which "the best public instructors" mislead their readers, it is stated that a clause was introduced into the Metropolis Gas Act, by which it was enacted that "all the preliminary expenses of the opposition to the Bill" were to be paid by the Metropolitan Board of Works. The writer founds this assertion on the harangue of Dr. Abrahams at the Court of Common Council; and, being in ignorance of the real facts, he supposes, as complaint is made in an attack on the gas companies of the improper payment of public money, that the companies must be the parties to whom it is to be paid—little thinking that the public-spirited promoters of the Bill are the sole recipients. This conglomeration of nonsense, ignorance, and fallacy concludes with a congratulation that, notwithstanding the present gloomy look-out, "there is corn in Egypt;" the promised grain being no other than the limelight, the general adoption of which, it is said, will "put an end to the murky, hazy, semi-darkness shadowed forth by what are facetiously termed burners of the old companies." From the whole tenour of the article, it is pretty evident that other agencies than impure gas were responsible for the murky, hazy, semi-darkness in which the benighted writer was plunged. It is really disgraceful to the public press of this country that such trash should be published in a journal having any pretension to respectability.

A visit is to be paid by members of the Manchester and District Junior Gas Association, next Wednesday afternoon, to the Globe Meter Works at Oldham of Messrs. J. & J. Braddock. Tea will be followed by an informal discussion on the relative advantages of wet and dry meters.

STANDARDIZATION OF GAS APPARATUS.

WHEN "Radiation, Ltd.," was formed, fully a year ago, it was one of the chief purposes in the minds of the firms constituting the company that they should, with the least possible delay, begin to concentrate their efforts upon a systematic scheme of standardization on the wide scale which was brought within the region of practicability by the joining of the resources of so many large manufacturing concerns. It was evident to them from the first that the standardization to be aimed at must not be confined to enlarging the arrangements already in existence in individual works, but must be a comprehensive system by which apparatus and parts would become inter-available throughout the whole range of goods of each class manufactured by all the concerns.

The objects to be gained by such a policy are of an importance which can scarcely be too highly estimated—both as regards the eventual simplification of the methods and details of manufacture and the saving of labour and money to which it would lead in the case of gas undertakings. This latter effect might be expected to result in a considerable further impetus being given to the popular use of gas apparatus, as general trade conditions permitted. Obviously, an aim so ambitious and so far in advance of anything hitherto attempted (not to say attained), could not be achieved all at once, nor in any other way than as the result of a vast amount of preparatory work by the individual concerns and in the central councils of the combination.

It was decided, therefore, to concentrate effort with a view to launching a substantial first instalment of the standardization programme which Radiation, Ltd., had sketched out for itself. The outcome of this concerted effort on the part of the five manufacturing concerns associated with the Company has now been publicly announced; and it will probably be recognized on all hands as a high testimonial to the forward state of their preparations and to the energetic and thorough nature of their efforts that a scheme so comprehensive and so far-reaching in its potentialities should have been brought to a stage of practical advancement and public announcement in no more than twelve months.

Taking, in order, the various branches of the scheme now announced, there are five gas-stove firms embraced in Radiation, Ltd.—viz., Messrs. Arden Hill & Co., the Davis Gas-Stove Co., Fletcher, Russell, & Co., the Richmond Gas Stove & Meter Co., and John Wright & Co.; and we find that there are five series of new gas-grates, each made and listed by a different one of the five, and each to consist of three distinct patterns with round, square, and ledge tops respectively. When a gas-grate of this kind is in position, only two castings are seen—*i.e.*, the front-frame casting and the fender casting; and the two together carry the entire design from the artistic point of view, and as regards the distinctiveness of the individual grates one from another. All the other parts, both metal and firebrick—including gas-burners, injectors, backs, fire-bricks, flue outlets, &c.—are identical, size-for-size, in all five groups. Thus only one set of parts in each size requires to be stocked by any gas undertakings for replacements in connection with any of the fires, even if they should happen to have all the five firms on their hire-lists and hire-out all three fires of each firm. Further, although in a strict sense it is proper to say that it is the parts other than the two front castings which are interchangeable, yet it stands to reason that if the front of any fire should get broken and there should be no castings at hand at the moment belonging to a fire of the same design, the fire can be instantly put into perfect working order by replacing the broken castings with castings of any of the other designs made by any of the five companies, because all the other parts will fit any of the front castings, no matter with what design of front they were originally supplied. It is difficult to conceive how simplification and standardization could possibly be carried further than this. The result is that the consumer has the opportunity of selecting from a wide range of gas-grate designs. Thus his choice, far from being at all restricted, is larger than hitherto; and yet the gas undertakings can afford him this wide range of choice at a far less cost in stock and in handling, as compared with the complications, and the large stocks hitherto required with what was after all a very restricted choice of design for the consumer.

A special feature in this new standardization policy is the production of a new inset gas-fire which, in addition to the fact that it is the most recent type, and is claimed to be of the highest efficiency, has the unique advantage from the standardization point of view that it is manufactured and marketed by all five firms in a form absolutely identical; so that every part, without exception, is interchangeable size-for-size with the equivalent parts, no matter from which of the five firms the inset gas-fire may have been purchased.

A standardized gas-heated wash-boiler, supplied in one pattern only by all five firms, is a further part of the present instalment. A standardized gas boiling burner is also announced. It is made in one pattern only at the works of each of the five companies; so that there is once more perfect identity and interchangeability. The advent of a series of standardized gas-cooker hot-plates, which also forms part of the programme now published, is an event which will be regarded with the utmost interest by all concerned, and the possibilities it opens up will readily suggest themselves to the mind. The illustrations and particulars of these cooker hot-plates, which are promised for a short time hence, will be looked forward to with keen anticipation.

Not second in importance to any of the present "Radiation" announcements is the statement that very shortly the firms propose to introduce a standardized "Slot" gas cooker. To produce such a cooker at a low price is a proposition which has been to the "Radiation" firms, with all their experience and equipment for the task, a very difficult one indeed; and it has involved the making of a large and costly installation of plant. It was hoped that it might have been possible to have produced this "Slot" cooker before now; but although it has not proved possible to get the preparations sufficiently advanced to realize the hope, there is now every reason to anticipate that the cooker will be ready for delivery before the end of the year. When it is produced, each of the five works will supply the same cooker—identical in every respect and every part. The question of the standardization of the "Slot" cooker having been exercising so many minds in the industry, this fresh departure on the part of the "Radiation" firms is one assured in advance of the heartiest of welcomes and the readiest and most careful consideration.

There will be, it may be confidently anticipated, the fullest recognition of the great enterprise and energy displayed by the management in planning, preparing, and bringing to fruition in so short a period their policy of standardization upon so large a scale and of so great promise for the future of the industry. The industry has long waited and hoped for a general standardization policy. However great the efforts of the individual firms, this ideal was only attainable by a combination of the leading gas-stove firms; and "Radiation, Ltd." is to be warmly congratulated upon having so soon signalized and justified its existence in a manner calculated to be of lasting benefit to the industry.

Uses for Small Gas-Motors.

The principal disadvantage of the gas-motor in its present form is its size, says Mr. L. W. Alwyn-Schmidt, writing in the "American Gas Engineering Journal" on the need for small-power motors. Practically all gas-motors which are employed industrially are comparatively high-powered machines, destined for the use of a centrally located power source with transmission gear leading to the various points of power consumption. The appearance of the electric motor, with its small power development, and the internal combustion engine of the gasolene type, has shown the enormous advantages of using individual motors in most industrial plants; and the gas-engine has failed to follow the lead given by these two newcomers. It is, however, from a different point of view that the writer, looking at the requirements in the United States, now recommends the construction of a small gas-motor. It has been argued that the use of gas fuel is impracticable in many cases, because it is difficult to supply gas to the points where it may be most required. This particularly concerns rural districts. But the gas industry in reality has a field of application much in excess of the community manufacturing plant in its present form. Successful experiments have shown that gas can very well be made from many other materials than coal. The gas industry would be wrong if it were not to use this opportunity for widening the application of gas, especially as there are great possibilities for such a development in the United States. There can be seen ahead the growth of a branch of the gas industry, building small plants for utilizing farm refuse of all kinds suitable for gas making, and employing the gas made in this way for the operation of gas-engines, or for heating. To make full use of this extension of the activities of the gas industry, small motors are required. The lack of such motors is to-day a direct impediment in the way of installing individual gas plants in such establishments. The farmer must have at hand a motor that works very economically. Similarly, gas engines of small power development might be installed in private houses, office buildings, &c., for producing electrical energy.

Midland Gas Managers' Association.—As already announced, the autumn general meeting of the Midland Association of Gas Engineers and Managers will be held to-morrow (Thursday) at the Grand Hotel, Birmingham, under the presidency of Mr. J. R. Duff, of Banbury. Apart from the election of officers for the ensuing year, the principal business will be the reading of a paper on "Industrial Furnaces," by Dr. C. M. Walter, the Engineer-in-Charge of the Industrial Research Laboratories of the Birmingham Gas Department.

Calculating the Weights of Steel and Iron.—Under the heading of useful information, the "Melting Pot," published by the Chicago Flexible Shaft Company, states that the specific gravity of steel is about 7·85, of grey iron 7·22, and of white iron 7·65. High-speed steels, however, owing to the percentage of metallic alloys present, are denser than ordinary steels. This increased density is not really constant; but, in general, high-speed steels may be considered as having specific gravities 15 p.ct. in excess of tool steel. The weight of 1 c.ft. of steel is approximately 490 lbs. The weight of 1 c.in. of steel is practically 0·285 lb.; and knowing the cubic inches in any bar or piece, its weight can be obtained by multiplying by this decimal. In ordinary practice, however, it is customary to multiply by 0·3, as most commercial steel is finished "full" to the dimensions specified. For the weight of wrought iron, multiply by 0·28, and for cast iron by 0·26, the results of which calculations will be sufficiently accurate for most purposes.

BRITISH COMMERCIAL GAS ASSOCIATION.

NINTH ANNUAL CONFERENCE AT SHEFFIELD.

THE Ninth Annual Conference of the British Commercial Gas Association was held on Tuesday and Wednesday of last week at the Cutlers' Hall, Sheffield, under the presidency of Sir ROBERT A. HADFIELD, Bart., F.R.S., D.Sc.

A DUAL WELCOME.

The LORD MAYOR OF SHEFFIELD (Mr. Samuel Roberts), in offering a welcome to the conference, said he fully recognized the enormous value of the British Commercial Gas Association, both to the gas and allied industries and to the community in general. All minds at the moment, doubtless, were on the great calamity which had come upon the country in the coal miners' strike. This was the first public opportunity which he had had to refer to this occurrence; and he felt it was a matter which was of great concern to the members of the Association and the public alike. Already the nation was facing the winter with the knowledge of a serious increase in unemployment; and it was a disaster that the country should now be plunged into this great strike. Whoever won the dispute, all would be losers by it; and the general body of innocent people must suffer intensely. It would be a long time before the country could get over this cessation of work, even if it lasted only two or three weeks. He was glad of the opportunity to acknowledge the debt which industry owed to the British Commercial Gas Association. The whole nation was interested in the economy of fuel, which meant so much to the country as well as to future generations. Although some people understood that the gas industry was a dying industry, he must remark that there were no signs of mortification yet. As one who knew a little bit of the great value of gas and of the bye-products obtained from carbonization, he was sure it affected every walk of life. He expressed the hope that the Association's visit to Sheffield would be pleasant and profitable.

Lieut.-Colonel H. K. STEPHENSON, D.S.O., M.P., LL.D., J.P. (Pro-Chancellor of the University of Sheffield and Chairman of the Sheffield Gas Company), in welcoming the conference on behalf of the Sheffield Gas Company, said it was a great delight to himself and all his fellow citizens of Sheffield to see one of their own most gifted citizens as President of the Association. Sir Robert Hadfield had done much for Sheffield and much for science, especially in connection with the iron and steel industry; and he was turning his attention, not for the first time, to the welfare of the gas industry, with, he was sure, great benefit to the community. He felt greatly interested in a double sense in the work of the "B.C.G.A." Not only did the Association, by its activities, increase the value and usefulness of gas undertakings—and he wished to express the Sheffield Gas Company's obligations to the Association—but it passed on the benefits to the community generally. He desired, on behalf of his fellow citizens, to acknowledge the debt to the Association. He was delighted to hear the Lord Mayor's warm welcome, because he had some recollection of a speech Mr. Roberts had made at a meeting of the Sheffield City Council some little time ago which gave him the impression that his Lordship rather regarded the gas industry as played-out. The Lord Mayor, he admitted, had protected himself on that occasion, as he had done that morning; and he believed the visit of the Association to Sheffield must be a special dispensation of Providence. He must admit that the Lord Mayor now seemed to be quite converted. For some occult reason the Government seemed to espouse the cause of electricity and to neglect that of gas. Therefore, it was necessary that there should be such a body as the Association, because the gas industry could not afford to hide its light. They were all prepared to acknowledge the uses of electricity—they used it on many of their own works for certain purposes; but electricity must not be allowed to usurp where gas excelled. There was a tendency, on the part of the public, to accept that which was put before them most prominently; and there seemed to be a tendency on the part of local authorities to spend more money on electricity than on gas, especially in the matter of street lighting. He believed that if the matter of street lighting were thoroughly investigated, it would generally be found that the very splendid effects of electricity would be still more splendid effects if similar money were spent on gas—indeed, these effects would be obtained at less cost. It was astonishing how prejudices clung and how slow the public were to recognize modern developments in gas appliances. There were some old appliances found in houses which ought to be no more. To-day, not only were gas appliances far superior to those formerly in use, but the new appliances were not the last word. The mission of the Association was to make the public see these things. The brains and skill of experts and scientists were at work in the furtherance of gas production and utilization. The part the gas industry played in the war had never been given full justice. Gas undertakings were bled white in their work for the country; and they were the only industry which received kicks instead of halfpence. While the majority of other war industries made excess profits, the gas industry had had its modest statutory dividends reduced. The Government had very autocratic powers under the Defence of the Realm Act; and considering the way in which they advanced the price of coal and the wages of labour, he felt that they could have relieved gas undertakings of the penalties and effects of Government action. In the case of the Sheffield Gas Company, the Directors were robbed of their fees because of limitations applicable only to pre-war conditions decreeing that if the price of gas went up beyond a certain point these things should happen. The Gas Regulation Act was an Act of tardy justice untempered by mercy; but no gas undertaking had yet derived any benefit from it, because the Board of Trade had refused until now to deal with applications under it—presumably in order that their officials should have their holidays undisturbed. All this kind of thing proved the great need for the activities of the "B.C.G.A."

The PRESIDENT, in response to the welcome, said perhaps he was somewhat of a tyro in gas engineering proper; but the great industry had always interested him, and had had his warmest support. The nation was at a very serious crisis at present; but he could not think common sense would fail ultimately to prevail. Speaking on behalf of the Government—which he could not claim to represent, but for whom he worked—he was sure they had done everything in their power to avoid the crisis. Now the only thing to do was to "wait and see" (though he did not care for this policy as a rule), in the hope that the other side might throw out some offer of friendship.

PRESIDENTIAL ADDRESS.

Sir ROBERT HADFIELD proceeded to deliver his Presidential Address, which he had divided up into fourteen sections. After dealing with the work done by other Institutions in the direction of securing fuel economy, he referred to the gas industry in Sheffield, the work of the "B.C.G.A.," the need for economy, the necessity for increased production, and post-war conditions. He continued:

THE SHEFFIELD GAS COMPANY.

As regards the interest taken by Sheffield in gas, which is, I may say, very considerable—its use here being on a very large scale—though I am one of the Directors of the Sheffield Gas Company, I believe I am correct in saying no city is better served. We had our difficulties to face during the war; but they have been surmounted. In this connection, I would like to mention one little incident. We—that is, the Sheffield Gas Company—freely placed our knowledge in matters relating to gas products used in connection with the manufacture of explosives at the service of our allies, including France. During the war, my friend Prof. Henri Le Chatelier, the renowned French scientist, came over to Sheffield to see me; and I obtained permission for him to visit the Sheffield Gas Company's works. On his return to Paris, he wrote and told me how greatly indebted he had been for the signal help we rendered him and his country in this respect. So, you see, Sheffield did its best to help not only steel, but also the commodity in which you are interested, gas—all for the common cause.

In connection with the Sheffield Gas Company, may I refer to two honoured names, the owners of which in the past did so much for it and for our great city? I refer to the late Sir Frederick Mappin and Sir Henry Stephenson, the father of our present able Chairman, Colonel H. K. Stephenson, D.S.O., M.P., who with his usual skill and energy is continuing this excellent work. Due credit should also be given to Mr. Hanbury Thomas, the General Manager for so many years, and the present holder of the office, Mr. Ralph Halkett.

To the first two enterprising and far-seeing citizens I have mentioned, Sheffield also owes a deep debt of gratitude for the encouragement and assistance given by them in developing our educational system, which I believe is second to none in the Empire. In the present Head of the University, Sir Henry Hadow, we have one who will worthily continue the traditions of that early band of workers for improved educational facilities of all kinds—Earnshaw, Mappin, Stephenson, Hicks, Ripper, and many others. To these names I add that of Dr. H. Clifton Sorby, F.R.S., the well-known Scientist and Microscopist, who was one of the Directors of the Sheffield Gas Company, and whose advice at the Directors' meetings I used to attend in days gone by was of the greatest assistance.

THE NECESSITY FOR INCREASED PRODUCTION.

The first essential to increased productivity with decreased physical effort per employee, at decreased cost per unit, remarked the President, is the organization and training of labour—that is the employment of brains (without which neither capital nor labour can efficiently operate) to direct, economize, and render more fruitful the brawn of the manual worker. The second essential to increased and cheapened production is the conservation and development of human energy. Production can further be increased and reduced in cost per unit by increased employment of mechanical energy for augmenting human energy.

But if we are to increase, and increase enormously, our use of mechanical power, it behoves us the more carefully to study how to make the best use of our wasting stock of stored-up energy—our coal supply. And this renders all the more imperative the consideration of the fourth means for increasing and cheapening our productivity—namely, the universal adoption of all modern methods of obtaining heat and power, which would result in cheaper factory construction, economy of space in factory utilization, increased speed and reliability of output, and decreased consumption of fuel per unit of production.

One of the most interesting items in the programme before us will undoubtedly be the paper which Mr. Thomas Goulden (the President of the Institution of Gas Engineers), than whom there is no greater authority, will be reading on the "Conservation of Coal." I have no doubt he will make clear in his exposition of this subject how grave is the loss to the nation of chemical substances which are of great value to industry in peace and invaluable to the country in time of war, when coal is burnt in its crude form, and also how wide of the mark our rulers were when they told us that the road to coal conservation lay mainly through the electric generating station. Where power is concerned, they were not far wrong, though for fairly constant load work gas can show a higher thermal efficiency. But where heat is required, except for certain special high-temperature processes, electricity is most assuredly out-distanced by gas in respect of coal conservation.

Before leaving the subject of productivity—increased and cheapened by means of the organization and training of labour, the conservation and development of human energy, the increased employment of mechanical energy, and the use of modern methods of obtaining heat and power—I would point out that, as you will learn from the readers of papers during the conference, the adoption of gaseous fuel in place of crude coal can play—and is, in my opinion, destined to play—a very important part in securing for the community each of those essentials to the restoration and expansion of our national wealth.

The President concluded his reference to taxation in a section generally reviewing the economic and industrial situation at the end of August last, by saying: I believe I was one of the first three individuals to see the then Minister of Munitions, when the Government of the day first foreshadowed the intention of Ministers to impose taxation of a special order. No one then could or did murmur. The nation's needs demanded drastic measures; but surely nearly two years after the war is over industrialists should not be groaning under war conditions. Tax the individual to pay his just share of the war. We all admit that the cost must be paid; but why should the whole of it be put on the present generation? Posterity is going to benefit; and it would seem only fair and equitable that the burden should be spread over a longer period of time. In any case, the industrialists should be assisted, and not hampered.

THE CONSUMPTION OF GAS IN STEEL PRODUCTION.

Sheffield is greatly interested in the production of gas—not only coal gas, but producer gas. This latter is now used almost universally to produce the high melting temperature (some 1600° to 1800° C.) employed in the manufacture of steel produced in the open-hearth process. Probably 80 p.ct. of the world's output of steel is made by this process. For 1920, the total production by all processes will amount to something like 70 million tons of steel, including the gigantic output by the United States, which, alone, is expected this year to total about 42 million tons.

As I pointed out in my address to the Society of British Gas Industries,* some 45,000 to 60,000 c.ft. of producer gas from coal will melt a ton of steel; the thermal units of the fuel being 9,400,000 B.Th.U. Of this, probably not more than 13·5 p.ct. of heat efficiency is utilized, and no less than 86·5 p.ct. lost.

In the appended table, a comparison of the cost is made for heating and melting steel and iron in coal, gas open-hearth crucible, and electric furnaces. It should be borne in mind that these figures are based upon the 1918 prices—*i.e.*, coal 20s. per ton, gas 1s. 4d. per 1000 c.ft., and electric energy 0·72d. per unit. As the prices of fuel mentioned are at present just double what they were at the time the data were prepared, the whole of the costs given will require doubling. The average price of coal from which producer gas is prepared is 39s. 5d. per ton.

The next sections of the address were on the subject of flames, the value of the use of gas, and the objects of the "B.C.G.A."

THE VALUE OF THE USE OF GAS.

The experience of my own firm in the use of town gas for fuel purposes, unsatisfactory as it was in some degree during the war, as a consequence of the grave difficulties which the Gas Company experienced in maintaining an adequate and consistent supply, has convinced us that, given sufficiency of pressure and consistency of quality at a moderate price, coal gas has great possibilities in the future of utility in manufacturing processes of all descriptions.

It must be borne in mind, also, that the extended adoption of what I prefer to call productive distillation of coal ("destructive

* See "JOURNAL," Vol. CXLII., p. 143.

COMPARISON OF COAL, GAS, AND ELECTRIC FURNACES FOR HEATING AND MELTING STEEL AND IRON.

Based on One Ton of Steel or Iron Heated or Melted.

—	Amount of Fuel or Energy Consumed.	Thermal Units in Fuel (B.Th.U.).	Cost of Fuel.		Heat Efficiency. P.Ct.	Lost Heat. P.Ct.	Tons of Coal Used in Producing Fuel or Energy.	
			Price.	Total Cost.			Tons.	Quality.
			HEATING ONE TON OF STEEL TO 900° C.					
	Coal Heating.		s. d.	s. d.				
(A) Theoretical 100 p.ct. efficiency	0·0182 ton (41 lbs.)	570,000	20 0 ton.	0 4¾	100	*Nil*	0·018	Ordinary.
(B) Practical	0·08 ton (179 lbs.)	2,510,000	20 0 ton.	1 7	23	77	0·08	,,
	Gas.		s. d.					
(A) Theoretical 100 p.ct. efficiency	877 c.ft.	570,000	1 4 1000 c.ft.	1 2	100	*Nil*	0·073	Bituminous.
(B) Practical	2750 c.ft.	1,790,000	1 4 1000 c.ft.	3 8	32	68	0·23	,,
	Electrical.							
(A) Theoretical 100 p.ct. efficiency	163 units.	570,000	·72d. unit.	9 9	100	*Nil*	0·21	Boiler coal.
(B) Practical	300 units.	1,030,000	·72d. unit.	18 0	54	46	0·38	,, ,,
			MELTING ONE TON OF IRON IN THE CUPOLA.					
	Hearth.		s. d.	s. d.				
Practical	0·15 ton coke (336 lbs.)	4,370,000	52 0 per ton.	7 9	23	77	0 225	Coking coal.
			MELTING AND FINISHING ONE TON FLUID STEEL.					
	Crucible.		s. d.	s. d.				
Practical	2·50 ton crucible coke.	73 000,000	47 0 per ton.	117 6	1·4	98·6	3·75	Coking coal.
	Open Hearth.							
Practical	0·30 ton producer coal.	9.400,000	19 0 per ton.	5 8	13·5	86·5	0·3	Producer coal.
	Electric, to melt.							
Practical	515 units.	1,780,000	0·72d. per unit.	30 11	68	32	0·66	Boiler coal.
	Electric, to melt and refine.							
Practical	780 units.	2,680,000	0·72d. per unit.	46 10	47	53	1·0	,, ,,

distillation" being here a distinctly misleading term), in place of its truly destructive combustion, not only secures many direct advantages for industry and for all individual citizens in their homes, but also secures for the nation as a whole the following important gains:

(1) Decreased coal consumption per unit of production, making it possible to increase the export of coal as payment for our food and raw materials, and as out-going freight to cheapen the transit cost of the in-coming.

(2) Increased production of wealth per ton of coal used in the country, through the conservation of those valuable chemical bye-products of coal distillation (or "carbonization," as it is generally called) which are lost when coal is burnt in the domestic or industrial grate.

(3) Decreased demand and expenditure upon our transport facilities, through the retail distribution of fuel being effected by underground pipes, instead of by traffic congesting coal carts.

(4) Reduced cost of building, both of houses and factories, through the elimination, partial or complete, of the chimney-shaft.

But, if the gas industry is to become the important "Factor in National Economy" which it can, and should, become in the near future, it is essential that the industry should set itself determinedly and immediately to the task of supplying gas of constant heat value, at constant and adequate pressure, at reasonable cost. During the war this was an ideal difficult to achieve—in fact, at many times, and in many places, impossible of achievement. But success now is imperative, if the gas industry is to make the great strides of which it is easily capable.

Further, gas suppliers must not rest content with delivering good gas regularly to their consumers. They must see that the consumers, both domestic and industrial, employ the most efficient gas appliances, and that these appliances are being constantly maintained in efficient order. They must see that their policy towards their customers is based on the soundest commercial principles, and is understood and followed in every detail by every employee, from the hall porter, the office boy, and the telephone operator, onward through the whole organization. And, not least, they must make widely known all the facts relating to the possible and advantageous uses of gas in home and in factory. In other words, they must carry on active and persistent publicity work—they must advertise.

CONCLUSION.

In concluding, may I say how much I am indebted to your able Executive Chairman, Mr. F. W. Goodenough, for his most valuable assistance in the preparation of this address. When he pressed me on your behalf to accept the honourable position of your President, I told him that, owing to the many calls and great pressure of work upon me, I was really unable to spare the requisite time for writing an address worthy of the occasion—especially in view of the many interesting topics which the conditions of the times present for consideration. I therefore ask you to forgive any shortcomings in the remarks presented; they have been written under high pressure and in difficult circumstances.

A Vote of Thanks to the President.

Alderman W. Kay (the Chairman of the Manchester Corporation Gas Committee), in proposing a vote of thanks to the President, said they were indebted to Sir Robert Hadfield not only for the connection of his name with the Association, but for the excellent address he had given, which was worthy of the widest publicity. The section on economy, in particular, should be in everybody's hands. They were indebted to Sir Robert for the impetus he had given to the Association's work.

Alderman W. F. Vint (the Mayor of Sunderland and Chairman of the Sunderland Gas Committee), in seconding, said the address contained valuable advice. Economy was written in every line of it, and that was certainly a most important point at the present time. The gas industry had gone ahead in a most extraordinary fashion. One of the greatest friends of the public in the present crisis would be the gas industry, to whom the people would look for heat, especially if coal were short.

The resolution was carried.

GIVING VALUE FOR MONEY; THE OPPORTUNITIES AND OBLIGATIONS OF A GREAT PUBLIC SERVICE.

By F. W. Goodenough, the Chairman of the Executive.

[See last week's "Journal," p. 139.]

DISCUSSION.

Mr. J. Somerville (Glasgow Corporation Gas Department), in opening the discussion, moved—"That this conference endorses the policy of the Association as laid before it by the Chairman of the Executive." In the far North the industry, and particularly the general public, had suffered in not having sufficient knowledge of the work of the Association. He was ashamed to say that last year, after the difficulties which they had to face as a result of the war, Glasgow had paid only half its usual contribution to the Association. In the interval, they had got back to the old figure; and Mr. Goodenough's visit to Glasgow had had good results. At the Glasgow meeting, a suggestion had been brought forward that a Scottish Committee should be formed to pursue the policy of the Association. In an area so far from headquarters the result would justify such a Committee.

Mr. H. Waddington (Halifax Corporation), in seconding the resolution, said he believed in the "B.C.G.A." policy because it was a sound one. When he was apprenticed as a boy to a distributive trader, his employer said: "Now, boy, you are coming to a business where you have got to have in the place what the customer wants, and you have got to find that and to sell it to the customer in such a way not only that the customer wants to come again and buy more, but that the customer wants to be served by you." That was the policy of the "B.C.G.A.;" but it went further, and tried to find out what the customer wanted before the customer left home. Mr. Goodenough had set the words of the "B.C.G.A." to delightful music. He was the master musician; and it was for the industry to interpret the musician's mind in their cities and towns, especially the smaller towns.

The resolution, coupling with it thanks to Mr. Goodenough, was carried.

Mr. Goodenough, in reply, said the President's suggestion that the work of Prof. Groume-Grjimailo should be translated and used by the Association would be considered very favourably by the Executive.

An Invitation to Visit Messrs. Hadfield's Works.

Mr. Goodenough then announced that Sir Robert Hadfield had kindly arranged to take over the great works of Messrs. Hadfields sixty or seventy of the members of the Association attending the conference, if they would hand in their names. He would like at once to express the thanks of the Association to Sir Robert.

Election of President and Auditors.

The President then announced that the ballot election for next year's President and for the Association's Auditors had resulted in the election of Mr. D. Milne Watson, M.A., LL.B. (President of the National Gas Council), as President, and Messrs. Cash, Stone, & Co. as Auditors.

Votes of Thanks.

Alderman F. S. Phillips (the Chairman of the Salford Gas Committee), in the unavoidable absence of Mr. Milne Watson—who had been detained in London by the Coal Control Department in connection with the strike—moved a vote of thanks to Sir Robert Hadfield for presiding.

The resolution was seconded by Mr. Thos. Goulden, M.Inst.C.E. (President of the Institution of Gas Engineers), and adopted.

On the motion of Sir Robert Hadfield, seconded by Colonel Stephenson, a vote of thanks was accorded the Lord Mayor for his presence and his speech. Colonel Stephenson remarked that he was particularly glad to do this on learning that the apparent incredible attitude of the Lord Mayor towards gas was not a fact.

The Lord Mayor expressed his regret that he had been unable to invite the Association to an evening social gathering at the Town Hall, owing to an engagement there for Municipal officers. He imagined that the Association's evening proceedings would be concluded earlier than those at the Town Hall, and would be glad to welcome any of the members there. In regard to Colonel Stephenson's observations, the few remarks he had made at a City Council meeting were in a speech in which he was doing his best to prevent the Corporation from buying out the Gas Company [Laughter]; and apparently he had succeeded. The Corporation were owners of the electricity undertaking; and he thought, in the interests of the community, that the competition should be maintained.

Speeches at the Luncheon.

The whole gathering adjourned for luncheon, in the Cutlers' Hall, as the guests of the Sheffield Gas Company. The President (Sir Robert Hadfield) presided, and was supported at the head table by the Lord Mayor of Sheffield, Lieut.-Col. H. K. Stephenson, the Master Cutler (Mr. William Clark), the Lord Mayor of Nottingham, and others.

After the honouring of the loyal toast, on the motion of Lieut.-Col. Stephenson, the Master Cutler proposed "Prosperity to the Gas Industry and to the Sheffield Gas Company." He said he wondered whether there was any irony in the request that he should propose this toast, seeing that he had been the first President of the Sheffield Gas Consumers' Association, and during the early days of the war was one of the Company's critics. [Laughter.] Before the war Sheffield had the reputation of supplying the best and cheapest gas, with possibly only one exception, in the country. The mistake early in the war, perhaps, was in failing to realize the tremendous expansion in the demands for gas. When the Company did tackle the business, they made the most modern improvements; and he had no doubt they would get back before long to the proud position they had occupied. There was a marvellous demand being made upon the gas industry; and there would be a greater demand upon it in the future. When electric light first came into use, they were told that there was no more need for gas; but the demand, instead, had increased every year. There was so much to be done with gas; and there was no place in which there was more to be done than in Sheffield. There was no judging the possibilities of the gas industry. Those who were industrial gas consumers were anxious that the gas producers should at all times associate themselves with the designers and engineers who devoted their time and attention to finding the best methods of gas-furnace construction. There was yet a great deal to be done in the direction of gas for industrial uses. The ordinary coal-gas industry was faced with rivals in water gas, producer gas, and coke-oven gas. Notwithstanding all that was before it, if the gas industry maintained the quality, without ignoring the chemical properties of which use could be made in other directions, they would find an increasing use of gas for industrial purposes. Sheffield would always be a large gas consumer; and he hoped the visit of the Association would assist in bettering the relationship between the gas undertakings and consumers.

Mr. Thomas Goulden (the President of the Institution of Gas Engineers), in the absence of Mr. Milne Watson, responded on behalf of the gas industry. The industry to-day, with the coming into operation of the Gas Regulation Act, had started a new era of prosperity which he believed would last for all time. It was not so long ago that one heard of a remark by a legal gentleman who ought to have known better, that gas was a decaying industry. This simply meant that the gentleman did not recognize that at that time gas had not come into its own. He had looked upon it as a field for lighting, and ignored

the still greater field for producing heat for both domestic and industrial purposes. This was the great field of the future for gas. Gas possessed the peculiar and satisfactory faculty that it blessed those who received; and they all hoped that for the future it would also bless those who gave, though it had not done so for the past few years. To look upon the great field in which gas benefited the community they need only refer back to the beginning of the war. Had gas been a decaying industry then, it would have had to be revived in order to enable the country to conduct the war successfully. [Hear, hear.] It was owing to the way in which the gas profession rose to meet the demand for high explosives, and bye-products for the dye industry and for agriculture, that the country was able to be maintained as it was. It was an industry increasing in value to the nation. To-day some 35,000,000 tons of domestic coal were being used by the nation every year, the bye-products of which were thrown away, not only to the detriment of the possibilities of their use, but to the injury of the health of the people. The industry had before it the ideal of the utilization of these products and the conservation of coal. The whole path of progress of the industry was in the direction of assisting the community. In the Gas Regulation Act they had a new Charter, by which they had much greater scope for more economical dealing with the coal, the conduct of their methods, and for the better service of the public. The greater latitude that was given to them in manufacture would be of immense assistance; and they would use it to the best advantage of the industry and the nation. He would like to couple with his reference to the passing into law of the Gas Regulation Act the name of Mr. Milne Watson, to whom they all owed more than to any one person who had had anything to do with the matter of the Act. Mr. Goulden said he would also like to take the opportunity of thanking Colonel Stephenson and his fellow Directors of the Sheffield Gas Company for their hospitality.

Colonel STEPHENSON, also responding to the toast, said it gave the Directors of the Gas Company great pleasure to receive and entertain the members of the "B.C.G.A." He was sure they all joined in regretting the absence, owing to the need to be in London during the strike, of Mr. Milne Watson. They recognized the great work done by this gentleman. By the irony of fate, it had fallen to the lot of the Master Cutler, who had been one of the Company's chief critics in the past, to propose the prosperity of the Company. He could assure Mr. Clark that the Directors very greatly appreciated the handsome manner in which he had discharged this duty. [Laughter.] The fact of the matter was that the Sheffield Gas Company had many years of almost unexampled prosperity, and were happy enough to be able to supply the best of gas at the cheapest price in the country, with the exception of Widnes. But evil times fell upon the industry during the war, and then hard things were said of the Company. He did not think the true facts were ever sufficiently recognized by the public. There were short supplies of everything during the war; but people seemed to think gas should be unaffected. When Mr. Lloyd George took over responsibility for the output of munitions, a demand was made on the Sheffield Gas Company which was beyond the capacity of the works to supply. The whole of the works were run at full speed; and they were bled white for the benefit of the country, having none of the partial cessations which were so necessary for repairs and renewals. The Explosives Department then refused the necessary priorities. Then the Department said they would get the needful things themselves, and they failed more ignominiously than the Company had done. When he took over the Chairmanship of the Company, in 1918, on his return from service in France, there was a slight *impasse;* but to-day, thanks to the devotion of the General Manager and his staff, and that of the workmen, the condition of the Sheffield Gas Company in regard to quantity and quality was better than ever before in its history. The Company had always had before it the benefit of the whole community. Although they had been accused of making a fetish of cheap gas, this ought to be accounted to them for righteousness, because the consumer obtained the benefit. He hoped the public would learn much from the work of the "B.C.G.A." of the great service which gas provided, and which, he was afraid, the people still failed to realize fully. Even to-day, in the majority of houses, they found old appliances of bygone days, and a great absence of the modern and highly efficient appliances. This, fortunately, was a state of affairs which was passing away since the war, and people were overcoming their apathy and the glamour of electricity. He looked upon the future of the gas industry as a very bright one.

Alderman A. BALL, J.P. (the Lord Mayor of Nottingham), proposing "Prosperity to the City of Sheffield," said they all wished the prosperity of Sheffield, because that meant the prosperity of the Empire. They recognized all that Sheffield had done in the winning of the war. The gas industry undoubtedly played a great part in the successful conclusion of the war. Most towns' gas undertakings had looked with envy upon the Sheffield Gas Company for years, and regarded the Company as the high-water mark of efficiency. Some of them, perhaps, thought they had at present got ahead of the Sheffield Company a little. The Chairman of the Company had told them that the concern had been partly worn-out by its efforts in the interests of the nation. He (Alderman Ball) believed this was largely the case in the industry generally. People had not been very generous to the gas industry during the war, forgetting that without it it would have been impossible to have won the war at all. They must never let the people forget how useful the gas industry had been and was to-day.

Mr. SAMUEL ROBERTS (the Lord Mayor of Sheffield), in response, said they had heard of various things which had contributed to the winning of the war. That evening, and at the recent dinner of the Society of British Gas Industries, in Sheffield, he had heard gas included in the claim. Lord Northcliff would probably say that propaganda won the war; and possibly the terms gas and propaganda were synonymous. [Laughter.] Times to-day were rather black; but they must all look for the best and hope for the exercise of the common sense of the British people, which had seen the nation through so many difficulties in the past.

Alderman F. S. PHILLIPS (Salford), proposing the toast of "The British Commercial Gas Association," said that the Association had a valuable function to fulfil. They had heard that morning that there had been some kind of feeling that gas had reached its zenith. He did not agree. He had held for years that the great time for gas was coming, and as time passed he became more than ever convinced of it. One of the greatest functions of the "B.C.G.A." was to do away with smoke, and bring back the sunshine to the people, and particularly to that portion of the people who were most dissatified with their conditions of life. He coupled with the toast the name of Sir Robert Hadfield (the President) and Mr. Goodenough (the Chairman of the Executive). Gas, he said in conclusion, was coming, not going.

Sir ROBERT HADFIELD, responding, expressed the hope that the Sheffield conference would prove a landmark in the history of the Association. He himself was only a humble follower of many great leaders. They owed to the ex-President (Lord Moulton) the greatest debt for the remarkable way in which he had worked-up the production of explosives during the war. During the speeches, reference had been made to the work of Prof. Henri Le Chatelier. They all acknowledged the great help rendered by the scientists of our friend and ally France. Their work would never be forgotten, and nothing must ever be allowed to part them from La Belle France. He congratulated the Sheffield Gas Company on the work they did during the war, even if the consumers did have some cause to complain that the B.Th.U. did not always reach 500. In regard to the Master's reference to the competition of water gas, he would point out that perhaps the Master Cutler was not aware that the Sheffield Gas Company themselves produced about 1,000,000 c.ft. of water gas per day. The "B.C.G.A." would be one of the greatest factors in the ultimate elimination of the smoky atmosphere of our cities and towns.

Mr. GOODENOUGH also briefly responded.

AFTERNOON'S CONFERENCE.

At the resumption of the public conference (National Economy Section) on Tuesday afternoon, in the Lower Cutlers' Hall, the chair was occupied by Alderman PHILLIPS, in the unavoidable absence of Mr. Milne Watson.

Mr. MILNE WATSON'S opening remarks (as follows) were read by Mr. Thomas Goulden.

The subject for discussion at the conference of which this meeting is a section is the very timely one of economy—with special reference to the gas industry as a factor in the economics of the community. The branch of the subject with which this section is concerned is its national aspect, as distinct from the individual aspects of the problem. The ways in which gas can directly assist the citizen in his home and in his business to secure the maximum of economy will be dealt with at to-morrow's meetings of the Domestic and Industrial Sections.

This morning we listened to telling words of wisdom from our President (Sir Robert Hadfield) on some of the fundamental laws which, whether we will it or no, govern our national life and prosperity—especially on that much-misunderstood question of the relation of production to real wages and to the volume of available employment. I will, therefore, not now touch upon that side of the problem, beyond endorsing everything that Sir Robert said, and commending his address to the thoughtful consideration of all engaged in industry—whether as investors, administrators, organizers, or manual workers. Many of the last-named are now, one is glad to know, also to be found in the first category as a result of profit-sharing and co-partnership schemes, in the development of which the gas industry has certainly played a not unimportant part.

Our discussion this afternoon will be directed to that side of economics which is specially concerned with the fruitful use of our national sources of wellbeing, and the avoidance of waste in their development and utilization, which is what we mean by "conservation." I use the term "wellbeing," in preference to that most generally used in this connection by economists, "wealth," because the word has come to have, for some people, reference rather to the possessions of a few individuals than to the realized and potential resources of the community as a whole, which is what is meant by the economist.

What are the main resources of this country, upon whose wise development and fruitful utilization our material wellbeing as a people depends?

First and foremost, the population of the country, its energy, its skill in the arts and crafts, and its general knowledge and wisdom. Mrs. Brereton this afternoon, and Dr. Saleeby this evening, will be talking to us on the ways in which the extended use of gas, in place of crude coal, can prevent waste and diminution of human energy, can raise the standard of vitality in our population, and can lessen the menace to life itself entailed by the conditions of existence in our towns and cities.

In these post-war days, when so many of the flower of our nation's manhood have been destroyed or mutilated, and when almost all our adult population and many of its younger members are suffering from the strain of war's sufferings, anxieties, and dangers, this aspect of "national economy" is of special interest and of literally vital importance. I am sure we shall listen this afternoon with much interest to what Mrs. Brereton has to say upon a subject to which she has devoted much thought, and which, I believe, first engaged her interest in the gas industry—the conservation of human energy, and in particular that of the woman in the home.

And to-night we shall be hearing from Dr. Saleeby something of the folly of which we are guilty in seeking cures for, instead of the prevention of, much of our disease and debility—just as we are now seeking £250,000 wherewith to remedy the accumulated damage to one of our great national spiritual assets (the Abbey of

Westminster) which is clear evidence of prolonged and gross misuse of one of our great national material assets—our coal.

Next to its population and their virility, skill, and wisdom, the most important asset to the nation is the land, and its fertility in foodstuffs for both man and beast. And here, again, the gas industry plays no negligible part; for a bye-product of the process of gas manufacture (known as sulphate of ammonia) is the best artificial manure for increasing the fertility of the land—a fertilizer, moreover, which is home-produced and does not, like the nitrates with which it competes, have to be imported to the detriment of the national balance-sheet and the rates of exchange. Every increase in the demand for gas means an increase in our home-produced supply of artificial land fertilizer.

But do what we may to stimulate the productivity of our soil, the land of this country cannot feed its population. We must turn, then, to our other natural resources—first for the wherewithal to purchase the balance of our food requirements and the raw materials for manufacture which this country cannot produce, and then for the provision of clothing, housing, and warmth for the people, together with the means of transporting the necessaries of life to them and the products of their labour to and from the centres of exchange.

This brings us to the great pillars of our material well-being—our large though by no means inexhaustible supplies of good coal, reasonably accessible, and of iron and its product steel.

Coal not only gives warmth for our homes and fire for our furnaces; it makes possible the manufacture of machines for the supplememting of our supply of human energy, and provides the stored-up energy of the sun of bygone ages wherewith to drive those machines, to propel our ships, and to give speed to our locomotives. It is the basis of our mechanical and of our chemical energy. When, as with us, there is next to no natural water power available, what a precious thing is this coal!

"Corn and potatoes, coal and iron, these are power," it has been well said; and again: "Civilization is the economy of power"—that is, its fruitful use. Said Solon to Crœsus, when the latter made display of his hoards of gold: "Sir, if any other come that hath better iron than you, he will be master of all this gold." And it was Locke who wrote: "He who first made known the uses of iron may be truly styled the Father of Arts and the Author of Plenty"—a saying that will be heartily endorsed in this City of Sheffield.

Not to multiply quotations, it may be said that philosophers of all times have realized and emphasized the basis value of coal and iron in national economy, and not least of coal, as without fuel iron ore is of no value in the country. It has been calculated that it would be necessary to fell every year a forest five times the area of the British Isles to give us fuel equal in heating power to our annual consumption of coal. It is "coal or nothing" with us.

Yet, with our national heedlessness of all but the comparatively near present, we have taken few, if any, steps to conserve—or shall I say to ensure that we are making the most fruitful use of—the steadily diminishing stock of this prime source of national prosperity; and this, moreover, in spite of warnings the most emphatic, from Edward Hull and Stanley Jevons in the sixties of last century, down to the Royal Commission of 1905. Indeed our warnings go further back by a long way; for as early as 1621 we find Dud Dudley (the man who first smelted iron with coal) quoting, in reference to the then "lamentable waste of thick coal," a proverb which ran: "He that liveth longest, let him fetch fire furthest." This proverb is becoming full of point for us, as our shafts sink deeper and our seams grow thinner; and at the present moment it may be commended to the miners as well as to the users of coal, for careful consideration and thought.

Mr. Goulden will be telling us to-day how we can prevent waste of this "mainspring of our national progress" by putting it through the process of distillation in the closed retorts at our gas-works, instead of burning it in open grates or under boilers and furnaces. But he will, I am sure, lay stress also upon the fact that by this process we find coal to be not merely a mass of potential heat and energy handed down from prehistoric times, not merely a fuel, but a veritable storehouse of chemical compounds of great variety and importance—compounds which are either entirely consumed or are released to befoul our atmosphere if the coal be burnt in the barbaric fashion that still prevails in so many of our homes and factories.

I think I have said enough—I hope not more than enough—to bespeak your interest in the subjects for discussion at this meeting; and I will now ask you to give your attention to the President of the Institution of Gas Engineers, Mr. Thomas Goulden, who will read to us his paper on the "Conservation of Coal."

Mr. Thomas Goulden then read a paper on

THE CONSERVATION OF COAL.

Of the many economical problems by which we are now beset, it will hardly be denied that among the most important and most pressing for solution are those that centre immediately in coal. Calculations show that the actual exhaustion of our coalfields may, for the present and for an indefinite time, be treated as negligible; but the comparative cost of raising coal is another matter. The expenses of raising coal have increased largely during the last few years; and owing to still rising wages and the decreasing amount mined per worker, to the thinner seams and greater depth worked, costs have evidently not yet reached their maximum. There are also hygienic considerations which should strongly impel us in the direction of avoiding the waste of coal of which smoke is the direct evidence.

The most serious direct loss due to the waste arising out of the consumption of raw coal is that of the valuable matters dissipated into the atmosphere. As coal is carbonized in gas-works, the resulting bye-products (besides coke) recovered for the use of the community may be scheduled as comprising:

	Per Ton.
Sulphate of ammonia	25 lbs.
Tar (from which by distillation the following secondary products are obtained):	10 gallons
Benzole or motor spirit (say, 1-14th gallon)	9½ oz.
Carbolic 60 p.ct.	13 oz.
Naphthalene	2½ lbs.
Anthracene	2½ oz.
Creosote	3 gallons
Pitch	72·8 lbs.
Cyanogen blue (used for printing and other commercial purposes)	3 lbs.

In the process of purification of the resulting gas, a quantity of sulphur is also recovered for industrial and other uses—15 to 20 lbs.—which has the double advantage of converting an objectionable agent of air pollution into a valuable commodity.

On the basis of the domestic annual consumption of coal being 35 million tons, the bye-products which are lost are:

Ammonia (expressed as sulphate of ammonia)	390,000 tons.
Tar	350,000,000 gallons.
Cyanogen (expressed in terms of "blue")	46,900 tons.
Sulphur	214,000 tons.

Truly a distressing tale of waste and atmospheric pollution, and one calling for remedy by all possible means.

Let us now consider the part played by the gas industry of the country in its employment of her greatest national asset—coal—and how far this industry may be able to contribute to the problem of coal conservation.

In this connection it is impossible to avoid reference to the very able and moderately expressed report on the "Coal Gas and Electrical Supply Industries of the United Kingdom," presented last year to the Institution of Gas Engineers by Sir Dugald Clerk, Prof. Arthur Smithells, and Prof. John W. Cobb. This report treats, with the characteristic thoroughness of its authors, of the thermal efficiency of gas manufacture and the use of gas by the consumer; also, for the purposes of comparison, the relative efficiencies pertaining to the production and use by the consumer of electrical current. The report is, in itself, an up-to-date text-book on the whole subject; and with due acknowledgment to its authors of the great indebtedness which not only the gas industry, but the public at large owes to them, it may well form the basis of our consideration of this subject.

In the calculation of the statistics referring to coal gas included in the report proper, the subject is practically confined to the consideration, from the point of view of thermal efficiency, of gas production, distribution, and use. The production of gas, therefore, is made to bear the whole heat loss belonging to its manufacture, with the result that the economies claimed for gas are conservative to the fullest possible extent, since the calculations include, against gas produced, any debits of thermal expenditure which might well have been placed against the production of tar (in itself possessing fuel value), of coke, or of other products, all of which are available and in demand for use by the community.

Since the products, tar and coke, both having economic fuel value, together with gas are results of the process of carbonization of coal, it would appear that the debit of thermal loss should be shared *pro rata* between them. The tar, though available as fuel, has a considerably higher money value for its constituent components, and therefore might well be called upon to carry a greater than *pro rata* debit; while, in addition, the ammonia produced might also (as having economic value) be debited with some proportion of the heat loss.

The full fuel value of the three products—gas, coke, and tar—is thus actually a conservative estimate of the realized efficiency of the total products.

Statements are made regarding carbonizing processes now in operation, in which the thermal efficiency of manufacture is placed in excess of 80 p.ct.; but such claims must be regarded with considerable reserve. Whether accepted or not, they cannot be held as in any way representative of average working. Under normal conditions, carbonizing efficiencies slightly exceeding 75 p.ct. are frequently obtained. The efficiency for gas now manufactured and delivered throughout the country is slightly over 70 p.ct.

It is obvious that it is the especial function of the gas industry to eliminate the domestic coal fire, which, so far as it is employed in areas served by gas undertakiugs, is clearly doomed. Professor Cobb was emphatic upon this point, in a valuable communication made to the "Edinburgh Review," January, 1919. "If," he wrote, "we are to work towards the ideal of smokeless cities, and recover the chemical value of coal, concerning which little has as yet been said, the open coal fire must go." "'Tis a consummation devoutly to be wished," and one which the gas industry of the country can best effect. Professor Cobb proceeded to demonstrate, in the same communication, that since the average manufacture of gas is conducted at 70 p.ct. efficiency, and as amply demonstrated at the University of Leeds and elsewhere, the modern gas-fire utilizes at least 75 p.ct. of the heat of the gas (50 p.ct. radiated into the room, and 25 p.ct. utilized by the heat

of convection), the combined heat efficiency of the gas-works and the gas-fire is very approximately 50 p.ct.—as against 13 p.ct. for the heat efficiency obtainable from electricity, even when the promised efficiency of the super-station is obtained. The average thermal efficiency of coal burned in the open grate may be placed at 25 p.ct.

My own experience fully confirms the accuracy of Prof. Cobb's statement, whose figures, applied to the 35 million tons of coal consumed annually in domestic use, might for equal duty realized be divided by one-half—an enormous advance indicated in the elimination of the smoke nuisance, which would simultaneously ensure that the great quantities of valuable bye-products now wasted would be realized for the use of the nation.

The use of electricity for heating, even at the high efficiency quoted by Prof. Cobb, would only be of advantage in the prevention of smoke from the domestic hearth; but its substitution for coal would involve the present consumption being nearly doubled, and the loss of all bye-products.

The domestic use of gas is largely for boiling water, for cooking, and for room warming. The resulting cleanliness in operation, convenience, and saving in labour due to its employment would ensure this in an increasing degree, even were no direct economy in fuel effected. The efficiency of gas employed in boiling water ranges from 50 p.ct. consumed in the ordinary ring-burner to upwards of 80 p.ct. in the geyser or water-heater. In cooking ovens, efficiency ranges lower, but is difficult accurately to determine. It has been calculated at from 8 up to 20 p.ct. The respective average combined efficiencies of manufacture and appliance used may, therefore, be assumed as (say) approximately 40 to 45 p.ct. for boiling water, and (say) 8½ p.ct. in the case of the cooking oven. Adopting Prof. Cobb's figure of efficiency of 13 p.ct. in the case of electricity delivered to the consumer, and 50 p.ct. efficiency in the electric boiler, the resulting efficiency of manufacture and use is 6·5 p.ct. for boiling water. For cooking, accepting 21 p.ct. as the oven efficiency, we arrived at the combined efficiency for manufacture and use of 2·75 p.ct.—both instances strongly in favour of gas as promoting economy in the use of coal.

For ordinary incandescent lighting by gas the consumption per candle-hour approximates to 23½ B.Th.U. At the manufacturing and distribution efficiency of 70 p.ct., this is equal to 33·6 units at the gas-works. Sir Dugald Clerk's figure of average electric production, in the before-mentioned report to the Institution of Gas Engineers—on the authority of the Technical Adviser to the Coal Controller—gives the average efficiency delivered to the consumer during the year ending March 31, 1918, as being 7·6 p.ct., while the best result in the United Kingdom by any electric supply undertaking was 11·7 p.ct. On these bases the B.Th.U. at the electricity works per candle-hour would be respectively 54 B.Th.U. for the average, and 35·1 B.Th.U. for the best result—the latter figure agreeing closely with that of gas efficiency. It appears, therefore, that so far as domestic lighting is concerned the margin of economy in coal expenditure for gas as compared with electricity is much less than in the case either of cooking or heating.

The foregoing statements clearly indicate the substantial economy in coal realizable by the more extended use of gas for domestic purposes. Advantages are also to be gained in the increased use of gas for industrial purposes, which would go far to reduce the 60 million tons of coal used annually in factories.

Time will not permit of the enumeration of the thousand-and-one applications of town's gas to present-day manufactures; and the author would refer his hearers to the various publications of the British Commercial Gas Association for particulars of this very extensive use of town's gas and to the papers on the subject that will be read at the present conference. The experience of the Gas Light and Coke Company, who maintain an experimental trade showroom in which appliances for meeting the needs of manufacturers are tested and perfected, also indicates the extended use to which gas for manufacturing purposes is capable of economical application.

Coke-fired circulating boilers have of late years been largely adopted for domestic use; their economy and utility, as well as convenience, being now generally recognized. The knowledge of the merits of gas-coke firing in steam-boilers for the production of steam for heating and power purposes is, however, so far, only limited; and it is owing to the propaganda of the London Coke Committee, and especially to the efforts of their very capable and energetic fuel expert, Mr. E. L. Nicol, that the advantages of coke as a boiler fuel are rapidly becoming better appreciated, especially in the Metropolitan area and that immediately surrounding it. Mr. Nicol has not only successfully demonstrated the fuel economy derivable from coke consumed in hand-fired boilers, in which an efficiency of 80 p.ct. is realized, but has also successfully solved the problem of the combustion of coke in the chain-grate furnace, by the adoption of the "sandwich" system of a combined coke and coal fire. Material increase in steaming power, and enhanced fuel efficiency, are found to result from this combination.

The more general substitution of coke in place of coal now consumed for steam-raising is most desirable; and that it is eminently practicable is sufficiently indicated by the large extent to which coke is now used as boiler fuel within the sphere of the London Coke Committee's operations. The resulting saving in the consumption of coal is difficult to assess. But it will evidently be important, and with it bring the further advantages of a cleaner atmosphere, and the transfer to the gas-works, for the beneficial use of the community, of the bye-products of the carbonization of coal, which otherwise would have been wastefully propelled into the atmosphere, to add to its unnecessary pollution.

Following Mr. Goulden's paper,

Mrs. M. A. CLOUDESLEY BRERETON read a paper on

THE CONSERVATION OF ENERGY.

The author pleaded eloquently, on behalf of the housewife for the adoption of labour-saving devices in the home. The "B.C.G.A.," she said, have already gone far in their efforts; and the Ministry of Health have given rather more than a nod of encouragement to plans for the installation of gas-fires in the parlours and bedrooms of new houses. But the Ministry have still to make such provision obligatory; and we, on our side, shall not rest content until we have secured that all new houses are fitted with the heating apparatus which we know to be the most economical—not only in money, but, what is far more valuable, the preservation of human energy and health.

Then there is another way in which the husband can take an interest. Supposing you say, "I should like this; it would make life easier. I should prefer to have a gas-cooker instead of the coal-range, with all the mess and the trouble of lighting the fire." The husband, perhaps, says it will cost more; but I can prove it will not cost any more if you use it properly. But supposing it did, you should take the household budget as a whole; and I think the average housewife could prove by the budget that the gas-cooker would not cost more. For instance, if your gas was going to cost you half-a-crown more per week, and you save half-a-crown on the laundry bill because there is less dirt, the weekly budget will be no more. You can see you will be no worse off in money; and I think I can show that you will be much better off in health through having a large amount of work taken off your shoulders.

I will ask the husband to take the question of the budget as a whole in discussing any rearrangement of his home. Supposing he is going to consider whether he can afford to have coal or gas fires in his bedrooms; and he asks the cost. Excellent people sent out by the gas department will come and see the rooms and tell him the cost. Supposing the cost is a little more than the cost of coal, he will be no worse off in money in the end; and he will have the advantage of saving the woman work.

And then there are the children. You cannot manage with babies without heat; and I do not know how you can get the heat as well in any other way as with a gas-fire. Where you have to pay people to look after a number of children, I do not see that there is any question that you can save in many ways. For instance, in one large house with many stairs, you can manage with one nurse for a large family of children; and this would save the price of gas many times over. Another advantage is that I prefer to have an educated woman to look after my children, rather than any other luxury in the house; and if you are going to have an educated woman—a trained lady nurse—you cannot have her cleaning out stoves or carrying coal scuttles up and down stairs, and at the same time have her there the moment you want her to look after the baby. The question should be considered from the point of view that the gas-fire in the nursery makes the nurse independent of the kitchen people altogether.

Then with the gas-fire and gas water heater you can regulate the heat. This is a great consideration for the mother without a nurse, who has to be in another part of the house, and often wants to do little things in the nursery for the growing child. The work with coal is enormous. There is also the question of the woman absolutely single-handed. Supposing she has to look after the child, and take it out in the morning shopping, and then go back to get dinner ready. What is she to do with a coal-range?

From this side of the question, the author turned to woman's life in industry, and the need for suitable working conditions. She showed the all-important part that gas can play in this connection.

DISCUSSION.

Prof. LEONARD ERSKINE HILL (London Hospital bacteriologist in research on ventilation) said Mr. Goulden had dealt very fully with the question of saving coal, and Mrs. Cloudesley Brereton had treated of the kindred subject of the saving of human energy. The latter was his own particular line. He drew attention to the terrible ravages of tuberculosis and other diseases, and to the immense part played by clean air and pure sunlight in the cure and prevention of such diseases. What an extraordinary inefficient condition the nation was in, he observed, when one considered the colossal waste of coal, while they knew, from facts and figures which were incontrovertible, that a saving could be made in both coal and human life. They had enormous suffering and disease and death in the cities; in unhealthy tenements housing eight millions of people. Now at the end of the war, they had to face these conditions with an exhausted exchequer. It was such conditions as these which led to the present unrest in the labour world. By the wasteful burning of coal they darkened our skies with smoke and soot, and kept away the healthy sunlight. He moved a vote of thanks to Mr. Goulden and Mrs. Brereton.

Mr. CHARLES F. DIXON (Darlington) seconded the proposition; and it was carried.

On the motion of Mr. GOODENOUGH, seconded by Mr. GOULDEN and supported by Ex-Provost HURLEY (Dunfermline), a vote of thanks was awarded Alderman Phillips for presiding at short notice.

Tea was thereafter provided for all present as the guests of the Sheffield Gas Company.

TUESDAY EVENING'S PROCEEDINGS.

The proceedings on Tuesday evening were of a social character, with a lecture by Dr. C. W. Saleeby, F.R.S. Edin., in furtherance of the campaign of the National Economy Section.

After a reception in the upper halls and an hour of pleasant music and social intercourse, Dr. Saleeby, in the lower hall, spoke on

THE CONSERVATION OF LIFE.

Dr. Saleeby said he was just back from the United States, where he had been greatly impressed by the cleanliness of the cities; and he was horrified by the comparison with Sheffield that day, as an example of a British city. He saw about the streets specimens of the same race as those across the Atlantic. How they proposed to carry on the Empire with such national physique, though taken from material which was probably the most splendid the world had ever known, he could not imagine. They were failing to produce the proper type of life, because they did not attend to the fundamentals of conservation of life. They were a city people, and they would have to breed and rear their children under city conditions. But they were not doing it. In the matter of air and light, their cities were disgraceful. The difference between them and America was, roughly, best demonstrated in London, where 600,000 got up every morning and lit coal-fires, whereas in New York nobody did this. Nowhere in America had he found any domestic burning of soft coal; the gas-cooker was absolutely universal. The campaign against smoke in America had been part and parcel of the campaign against tuberculosis; and the Americans had reduced the disease to one-third of its extent twenty years ago. In Boston, they had the "Blue Sky Law" for the abolition of smoke; and it was time we had such a law in England. In Pittsburgh, formerly described as "Hell with the lid off," where the great steel industries and the geographical situation tended to the gathering of smoke over the town, there was now less smoke than at Nottingham, which was reputed to have less smoke than any manufacturing centre in England, because of damage to the lace. Since he had learned in his medical student days of the evil effects of smoke on health, he had never bought or burned an ounce of coal for his own consumption.

[Dr. Saleeby showed on the screen a few pictures of Sheffield on a Sunday, when it is comparatively clear, and on working days.]

On the motion of the President, seconded by Mr. J. H. Laverick (General Manager of the Tinsley Park Collieries), a vote of thanks was accorded Dr. Saleeby.

Refreshments were afterwards served in the beautiful upper halls, by the generosity of Colonel and Mrs. Stephenson, as ex-Master and Mistress Cutlers of Sheffield.

WEDNESDAY'S PROCEEDINGS.

On the resumption of the conference on Wednesday morning, at the Cutlers' Hall, a private session was held, at which the subject for discussion was "Business Development in the Gas Industry." Mr. F. W. Goodenough presided.

Report and Accounts—Increase of Subscriptions.

The Chairman moved the adoption of the report and accounts of the Association for the year 1919-20, and drew attention to the financial deficit in consequence of the greatly increased cost of administration and working. Gas undertakings would shortly be asked to increase their subscriptions to the Association and the National Gas Council jointly, to 5s. per million c.ft., instead of the present 3s. 6d. He also called attention to a proposed alteration of rules, providing for more democratic election of officers of the Association.

The adoption of the report and accounts was seconded by Alderman Vint (Sunderland), and carried.

Mr. W. M. Mason (the Secretary of the Association) read a paper on

ATTRACTING ATTENTION AND CREATING INTEREST.

How the Association assists local business development was explained by the author, who first set himself to answer the question, "What is advertising?" Advertising, he said, is notifying the public that you can supply an existing demand, and educating the public so that they will in growing measure demand what you can supply.

Of course, cheap gas is a good thing, but cheap gas *plus* good service—which surely includes the education of the consumer in the use of the commodity and in the most efficient appliances for giving good results—is far better. I might even go so far as to state—for we have abundant proof of the fact—that highly-priced gas *plus* good service and wise publicity methods will sell more gas than low price *plus* poor service. The simplest of all facts proving the point is that the greatest sale per consumer is not to be found where the cheapest gas is sold—not by a long way. It requires but a superficial consideration of the facts to make one realize that it is both necessary and profitable to advertise gas, because there is very widespread public ignorance in regard to its many possible and profitable uses.

But it is not only public ignorance of a negative kind about gas that we have to remedy. There are public prejudices against gas based upon ignorance with which we have to deal, and which the national campaign of the Association has already done much to remove. The prejudice against gas-fires has taken (and in many districts still requires) a considerable amount of killing; but the Association have done, and continue to do, much valuable work in this connection. Then, because of its greater novelty, there is even more ignorance about the possibilities of gas for water heating than there is about gas-fires; and the Association are doing work of great value to every gas undertaking in the country by constantly bringing the question of hot-water supply by gas to the notice of the householder and of business men. Again—and this is by no means the least important point—there is widespread ignorance about the industrial uses of gas, its almost unlimited possibilities as a fuel as well as a source of power in our factories and workshops. We have got a good thing to sell; the public is ignorant of many of its possibilities; it is necessary and profitable for us to publish the facts constantly and effectively. That broadly is the case for advertising.

Granted, then, that it is necessary and profitable to advertise gas, the questions to be considered are: How can the necessary advertising be most effectively and economically done? Shall it be done locally or by a national campaign? Is it best to send your money to London to be spent by the B.C.G.A., or would it be better to spend it in your own town? What do the Association do with and for the money subscribed to their funds?

Can the necessary advertising be best done by local or national effort? The answer is that both local and national advertising are necessary, that they are complementary to each other, and that each adds to the value of the other. In the scheme organized by the Association, there are three subdivisions of the publicity campaign—national advertising, district advertising, and purely local advertising. The Association conduct the first two branches of this co-ordinated campaign, the national and the district advertising, with the funds subscribed by the supporting undertakings, and enable subscribers to conduct the third branch (the purely local advertising) far more effectively and infinitely more economically than any undertaking could do without the Association's assistance. There is also the very important "indirect publicity" campaign carried on by the Association, of which subscribers do not know much, but from which the whole industry greatly benefits.

It is no exaggeration to say that an undertaking subscribing to the "B.C.G.A." can get as much local publicity value out of £100 by our assistance as it could get out of £300 spent as a local tradesman would have to spend it. It can therefore well afford, out of the £200 saved, to send £100 to the Association, from which it will reap further benefit by way of the national and district advertising and the general propaganda work done from headquarters.

If it were possible to imagine the gas industry without the "B.C.G.A.," and the statement regarding its organization and service which we have just been considering was, for the first time, submitted to you, would it not, think you, meet with the heartiest approval of all? Does it not, therefore, come with something of a shock to realize that there are still 1000 gas undertakings drawing benefits from the national propaganda who are doing so without paying any share of the necessary expense? And they are not all in Scotland! This is more to be wondered at when we remember that the basis of 2s. 6d. per million c.ft. of gas made really only represents on the average an expenditure of one penny per gas consumer per annum; or, put another way, a business with an annual turnover of £200,000 investing £100 in publicity. The subscription is not so much money sent to a central body to spend on its own concerns; it is really money collected in a co-operative "pool," and spent for the contributors with much greater benefit to the contributors, for the extension of their own business, than could be secured by individual expenditure of like amount.

Mr. F. H. Holland (Director of Sales Organization) delivered an address on

THE ECONOMY OF EFFICIENCY.

The author suggested that the time has come when we should study how all our people do their work, so that we may eliminate superfluous motions and cumbrous methods, and so conserve human energy.

In addition to close study of operations as a means for securing higher efficiency, other conditions must be taken into account before any—what shall we say?—"datum-lines" or efficiency standards can be adopted. For instance, in dealing with the question of fitters' wages, adequate payment resolves itself into the number and type of jobs which can be performed by the various grades of men, and the amount which the industry can afford to pay for the performance of each.

So far so good. This is where the trouble begins. When standard wages for the country, or even for districts, are being established, it will be found that a fitter in one town can only do ten jobs per day of a certain type, but that a similarly skilled man in another town can do fourteen, simply because the latter district is a congested area, and there is therefore less time occupied in walking from one job to the next. The material part played by this factor is shown by the fact that the average walking time for the industry's fitters is 20 p.ct. of the total wage time. The total unproductive time is 30 p.ct.

Now, obviously, the undertaking having the congested area can afford to pay higher wages than one having a straggling one. Its men can do more jobs, and so the labour cost per job is less. Is it not obvious, therefore, that no standard wage per job for the country would meet both cases? Frankly, I am of opinion that the whole problem should be approached from the opposite point of view—separate datum-lines for separate undertakings.

It is well to recognize the danger of standard wages. Efficiency can only be secured by studying the facts as and when they occur, and then by building-up a structure upon them. I do honestly suggest that, in the gas industry, no one should any longer act as if every fitter, clerk, and inspector were as good as every other fitter, clerk, and inspector receiving the rate of pay, but that every undertaking should seek to establish the efficiencies of each employee—cut out all unproductive labour, pay the very highest possible wage, *plus* extra pay for the highest possible efficiency, and so build-up a contented industry, serving the public at the minimum cost.

Is this practicable? Yes, it is. A scheme has already been formulated for increasing consumptions and establishing the efficiency of both salesmen and selling effort. Certain gentlemen in this room know that I am stating a fact when I say that this scheme is doing both things. Furthermore, in order to secure greater efficiency in offices, stores, and district work, analysis has been made regarding the departments on the commercial side of the industry. It may surprise some of you to know that, in certain undertakings, three men are doing as much work on the district as four men did twelve months ago; and I should not be at all surprised if, in the course of the coming year, we do not succeed in getting double the district work from our men with much less fatigue to them, but at a substantially reduced job cost to us.

Efficiency in the stores is equally as economical. Material is very costly in these days—not so costly as time, but still very costly; and we need to study not only the planning of our stores and the arrangement of the bins to lessen stores fatigue and the reduction of fitters' time which can be effected each morning by more rapid issue of material, but the actual value of the stock we hold. It is rather a surprising thing that greater attention has not been given to this point. There are more reconciliation statements of stock in the gas industry than there are accurate stock records. We need not reconcile book stock and actual stock, because we can make the book stock "the stock," and entirely eliminate closing-down our stores for stocktaking purposes. Efficiency, studied as an art in itself, does pay. It does bring economy; it cuts out wastage; it does away with clerical duplication; and it reduces systems to the barest necessities. I am very glad to be able to say that the industry is appreciating these things in growing measure, and, what is even more important, it is improving commercial methods, and thereby securing better results with the minimum waste of time, effort, and material.

Some managers in the industry doubt whether men who are not actually working in their offices can effect such improvements. To these, may I be permitted to explain that the Sales Organization Department of the "B.C.G.A.," which I have the honour to represent, possesses more data (arrived at by close investigation and thorough discussion) than any one manager in the gas industry? Therefore, we are not inexperienced in the true sense, but are able to suggest improvements and alterations from our fund of information.

As an illustration, many men know the books which are kept in their own offices; but how many know the books which are kept in other offices? They know their own systems, and sometimes what they cost to run; but how many know other systems, and what they cost to run? Some foremen know how many jobs their men do in a week; but how many know how many they could and should do? There are thousands who hold opinions; but how many know the absolute facts?

We know some of them, and are steadily learning more—simply because the law of averages reveals them. It tells us that the average job at present charged-for takes 180 minutes, and that the average free job (complaints, and so on) takes 38 minutes. Efficiency can therefore be computed from this common basis. We can say how many jobs should be given to each man per day by the foreman; and, until every undertaking in the country possesses this information, it cannot secure higher efficiency. Until you know what a man does to-day, you cannot say what he should do to-morrow. Until you know that an automatic-rental clerk of reasonable efficiency can post 300 cards per hour to the card record of automatic consumers, you cannot say how many clerks should be employed per day in dealing with, say, 30,000 consumers' records. And so one can go on, item by item, operation by operation, through office, stores, and outside work.

Pooled experience is invaluable. The Sales Organization Department of the "B.C.G.A." is performing just this function of gathering into the Association's pool the facts relating to the operation of commercial departments. It gathers information north, south, east, and west; and suggestions based on the whole of this information are available for each subscriber.

Please forgive me for being enthusiastic regarding the economy of efficiency. Some men say I am a crank upon this subject, and that I forget that a small undertaking is unable, by reason of its very size, to adopt half the proposals which are made. I should like to say to such doubters that we serve some of the smallest undertakings in England as well as some of the largest. We are working with managers and securing results far in excess of the cost of our service.

In conclusion, may I plead for more support in this work. Much remains to be done. Every undertaking does some particular thing in an efficient way; and, if we can only collect all the data regarding these efficient methods and weld them into one complete whole, we can distribute the facts to enable all managers to operate their commercial departments on the most efficient lines, and, by maximum service and minimum charges, to demonstrate to the public the economy of efficiency.

Mr. H. Austen Hall, F.R.I.B.A. (Past-President of the Architectural Association, and Consulting Architect to the Association) gave an address, illustrated by lantern slides, on

SHOWROOMS AND OFFICES: THEIR DESIGN, PLANNING, AND EQUIPMENT.

Mr. Hall said the great majority of so-called show-rooms of this country were little better than ordinary shops, suitable for any other purpose, in which gas-stoves were placed against the walls and the ceilings were hidden by hundreds of pendants massed together. The effect was depressing, and gave the public no idea of the charm which suitable fittings should possess in their own homes. The method of outside lighting was frequently confined to excessive light, without any preconceived sense of illumination in relation to the building. The speaker's idea of a gas show-room was that it should be designed to express the beauty of good lighting within surroundings that enhanced the value of the fittings, without competing with them in interest. The show-room must express in the highest degree the comfort with the elegance of the home; and this was best illustrated by the use of model rooms. This should show the model kitchen, the sitting-room or bedroom, and, perhaps most important of all, the model bathroom. It was the application to life of inventiveness in the gas industry that reached the public mind; and the mere exhibition of numberless stoves and lights—which were more properly confined to stock-rooms—could not attain this object. The model room could be shown not only inside the building, but also in the windows, particularly in the case of kitchens, in which demonstrations could be made. The window display reached a far greater public than did the internal show. The show-rooms should not be unduly crowded with fittings. The effect was spoiled, and the purchaser became wearied when confronted with a great variety of exhibits closely arranged.

The common fault was lack of proper ventilation in the show-room, and the consequent smell of gas, due to many appliances burning for purposes of exhibition. The gas plant for driving fans for exhaust and intake of air, it should be remembered, was itself a valuable exhibit. He held that the architectural character of the show-rooms must enhance the cost of the exhibit without competing with them unduly. Goods should be so arranged that the credit for attractive appearance would be given by the customer to the goods, and not to the building. A sense of cheerfulness must be a dominating factor, and good architecture was necessary to illustrate the successful application of gas lighting and heating.

Mr. Hall showed, with the aid of the lantern, pictures of model rooms, architectural features, and display of goods. In conclusion, he said he thought the excellent work done in the planning and designing of gas show-rooms and offices in this country and in America needed only to be realized to effect a universal improvement in the general standard taste. The industry needed the best skill and thought available on the subject to develop all the possibilities attached to the publicity side. There was great need for imagination and fresh thought.

Mr. F. W. Goodenough gave an address on

OBTAINING AND RETAINING BUSINESS.

He said there was as yet no comprehensive series of text-books dealing with the business development aspect of the industry; but it was a need which would have to be met in the near future. Sectional meetings of the "B.C.G.A." should be of real value to the officers taking part in the work and to the undertakings which they represented. It was hoped that the latter would give their officers facilities in regard to time and expenses for attending meetings regularly. The first way to obtain business was to arouse the favourable attention of the potential buyer to the fact that the undertaking had something to supply. Having attracted favourable attention—not, it should be noted, unfavourable attention, which was easy enough to attract—it was necessary to excite personal interest which would create desire to possess and stimulate that desire until it was powerful enough to overcome the natural reluctance to spend money or to make changes. The process was a continuous one, because then came the part of the seller in executing the orders of a customer by offering something that the buyer wanted and something to be relied upon to fulfil all that was promised. The customer must be given confidence that satisfaction would be secured. Confidence was the basis of trade. Obtaining and retaining business was only a question of obtaining and retaining the confidence of the public. Gas suppliers must never promise more than they could perform, and, whenever possible, they should perform more than they promised. Gas undertakings must realize the value of a broad-minded policy and a good staff. He pleaded for the widest possible recognition throughout the industry of a living progressive public service policy, carried out by a staff filled with knowledge and inspired by the enthusiasm which came from working upon the right lines for the right people to a right end.

The Luncheon on Wednesday.

At the Grand Hotel the Directors and members of the Sheffield

Gas Company and the members of the conference were entertained to luncheon by the President and officers of the "B.C.G.A." The PRESIDENT (Sir Robert Hadfield) presided.

The loyal toast was honoured, on the proposition of the President.

Mr. F. W. GOODENOUGH, in proposing the toast of "The Directors, the General Manager, and the members of the Sheffield Gas Company," expressed the high appreciation of the Executive and members of the "B.C.G.A." of the help given to the conference by the Gas Company of Sheffield. The Association was deeply grateful to the Directors; and they were glad to add their testimony to the work of the General Manager of the Company (Mr. Ralph Halkett). Mr. Halkett had not been in Sheffield very long; but already he had made his mark in the welfare of the community.

The PRESIDENT said he would like to add his testimony to the good public work of the Chairman of the Sheffield Gas Company, Colonel Stephenson, as Lord Mayor and as Master Cutler, and in many other directions.

Colonel STEPHENSON, responding on behalf of the Directors, said that, in spite of the stormy passage they had had during the war, the trouble was now past, and, owing largely to the excellent management of Mr. Halkett and the general improvement in organization and machinery and the favourable prices for residuals, they had weathered the storm, and had avoided any increase in price for gas since August, 1919, which was more than most gas concerns could fairly claim. The Company were supplying to-day a better quality and at a higher pressure than ever before. So far from considering any increase in price, they had been seriously considering whether a decrease was possible—in fact, at a recent Board meeting they had decided to make some reduction if the coal strike did not happen. Unfortunately the strike had happened, and prevented the reduction at present; but they hoped and believed a reduction would be possible before the end of the present year. It was important that the whole community should realize what the coal strike meant to the people. He had been forced to the conclusion that the thing the miner dreaded most was any form of payment for what he did, rather than for the time he spent in doing it. He was satisfied that, whenever a system of payment by results could be properly applied, it was the only system which was fair alike to employer and employee, and gave both an individual interest in their work. He believed in a man being paid for the work he did, and not for what he pretended to do.

Mr RALPH HALKETT (the General Manager and Engineer of the Sheffield Gas Company) endorsed the pleasure which it gave to the Directors and himself to have the "B.C.G.A." at Sheffield. They felt honoured, because of the great work which the Association did, and because of the still greater work before it in letting the public know what gas could do. Gas had come forward greatly for industrial uses in recent years. He believed the Sheffield Company during the war had really been too good Had they refused to do so much for the nation, they might not have had so much thrown in their teeth subsequently. The public had a short memory, and did not give credit for what was done. The "B.C.G.A." were not only great advertising agents, but practical demonstrators of all that gas could do. He wished to couple with his remarks a word of recognition for the support of his staff. Whatever the Company had been able to do in connection with the conference could not have been done without the loyal co-operation of his staff.

Sir WILLIAM CLEGG, proposing the toast of "The President," said Sheffield knew and valued Sir Robert Hadfield, and had followed his industrial and scientific career with delight. Assisted by a band of loyal colleagues and a most efficient staff, he had built-up a concern which was known throughout the world. Sheffield had marked its appreciation by conferring on him the degree of Doctor of Metallurgy of Sheffield University—the only university in the world, he believed, which could confer that distinction.

Sir ROBERT HADFIELD, responding, said he had been able to render a few services to his native city; and in the scientific and metallurgical world he had done his best to show that the true way of progress was by research. They must never rest content with what they already knew.

On the motion of Mr. ALFRED PROCTOR (Chairman of the York Gas Company), seconded by Mr. CHARLES WOOD (Engineer and General Manager of the Bradford Corporation Gas Department), a vote of thanks was during the morning awarded the readers of papers.

WEDNESDAY AFTERNOON'S SESSION.

The conference at the Cutlers' Hall, on Wednesday afternoon, was divided into two simultaneous sessions—the Domestic Economy and the Industrial Economy Sections.

GAS AS AN AID TO ECONOMY IN THE BUILDING, EQUIPMENT, AND RUNNING OF THE HOME.

In the absence of Alderman Kay, of Manchester, Alderman A. BALL, the Lord Mayor of Nottingham, presided over the Domestic Economy Section, at which the subject of discussion was "Gas as an Aid to Economy in the Building, Equipment, and Running of the Home."

Alderman BALL said the subject was a very wide one. Prof. Cobb's paper was of great importance in the matter of obtaining the most satisfactory results from the use of gas. Important work had been done at Leeds of late years, under Prof. Cobb and Prof. Arthur Smithells; and the public owed much to these two gentlemen and their assistants. The meeting would hear from Prof. Barker of the work done at the University College, London, with a view to determining the relative efficiency and utilities for cooking and heating of apparatus of gas, coal, oil, and electricity. The work at these institutions had been entirely free from interference by the Association, though the funds subscribed by supporters of the Association had for some time provided a considerable part of the sums necessary for carrying out this research work. The one object the gas industry had in assisting such research work was to obtain the best opinion for its guidance and for the guidance of the public so that consumers would be sure of getting the maximum value from the gas at the minimum cost. There was, of course, no philanthropy in this—simply common business sense and common honesty. The three papers of the afternoon would give much valuable information to those who were interested in the great housing problem, and they would help towards solving that other urgent problem—smoke abatement. Whatever might be the prospects of freeing existing towns from smoke, they could at any rate resolve that everything possible should be done to ensure that the houses that had to be built by the hundred thousand in the near future should not add to this blight. The interim report of a Committee of the Ministry of Health acknowledged that means for cooking and heating without smoke were practicable and desirable; that wherever gas was available the gas-cooker should be installed in lieu of (not in addition to) the coal-range; and that, as far as practicable, gas-fires or hot-water radiators should entirely supercede the open coal-fire. The Committee reported that the present housing situation afforded a unique opportunity for constructive reform in heating, cooking, and hot water supply. The question for housing authorities and for the citizens who elect such authorities was to consider quickly whether the recommendations of that Committee were to be acted upon or ignored. The papers of the afternoon would constitute a strong argument in favour of the Committee's recommendations; and he appealed to representatives of housing authorities present not to miss the great opportunity which lay to hand.

Mr. SAMUEL TAGG, Engineer and Manager, Preston Gas Company, read a paper on

DOMESTIC USES OF GASEOUS FUEL; ITS ECONOMIC AND HYGIENIC ASPECTS.

If you are interested in the opinion of a scientific man as to the efficiency of an ordinary coal-range designed for the triple purpose of heating the kitchen, cooking the food, and supplying hot water for the home, I would refer you to a course of lectures delivered by Prof. Barker in 1918 at the London University. He concludes a careful examination of the efficiency of each purpose the range is designed to perform by a scathing condemnation of them all in the following terms: "If the whole design were put together with the deliberate idea of wasting fuel by disregard of every known principle of economic combustion, it could hardly be more perfect."

In my experience the coal consumption of a kitchen range for a family of five persons is not less than 2½ cwt. per week, or 6½ tons per year. A generous allowance for the duty performed in heating the kitchen is 2 tons per year; and an accepted figure for the additional fuel required for the back boiler is 25 p.ct. —making a total consumption of 2½ tons, which leaves a difference of 4 tons to be debited against the cost of cooking by coal.

The whole of the cooking can be done with gas in less time and in greater comfort on a consumption of 20,000 c.ft. to 30,000 c.ft. a year, at a cost with gas at 4s. 6d. per 1000 c.ft. of £4 10s. to £6 15s., compared with coal (at 50s. per ton) of £10.

Prof. Barker in the lectures just referred to criticized the low efficiency of the boiling-rings on the hot-plate of the gas-cooker, which are used probably more than all the rest of the burners together, and which was stated by him at 20 to 25 p.ct. Thanks to the research work undertaken by the principal manufacturers of appliances, the designs of the burners and hot-plate have been improved, so that to-day efficiencies of 40 to 50 p.ct. are readily obtainable in ordinary use.

The superiority, on hygienic and economic grounds, of gas over coal for cooking purposes is so clearly established that most of the housing authorities have installed gas-cookers with open coal grates fitted with back-boilers, in place of the ordinary kitchen range in the houses in course of erection.

In existing installations which include a coal range, the full economy of a gas-cooker is not realized unless provision is made for the supply of hot water by a gas-heated boiler. Otherwise the range must be lit during the summer months in order to supply this service. To meet this requirement there are a variety of gas-heated boilers available, the choice of which must depend upon the particular conditions.

In ordinary circumstances, it is more economical to rely upon the coal-heated back-boiler for the general supply of hot water, and to use the gas-heated boiler either when the kitchen fire is not lit or to supplement the supply from that source when additional quantities are required. In many homes the replacement of the existing kitchen range by an open fireplace fitted with a back-boiler, and the installation of an auxiliary gas-heated boiler and gas-cooker, would not increase the total fuel costs, and would effect a very great reduction in labour, and materially add to the comfort and convenience of the home.

In Lancashire towns the gas-heated washing boiler is rapidly displacing the less convenient coal-heated copper, and has been universally installed by housing authorities over the country. Low in initial cost and simple to use, the running costs with gas at 4s. 6d. per 1000 c.ft. do not exceed 2d. per hour. As suggested, they may in some cases be utilized for a supply of hot water for the bath.

In still another department of the home it is found more economical to use gas—viz., for the heating of rooms in occasional use. Dr. Margaret Fishenden has recently concluded an elaborate and valuable research into the efficiency of the coal fire for the Manchester Corporation Air Pollution Advisory Board; and in her summary of the question she states that the total amount of radiant energy thrown into a room from coal burning in an open grate varies little with the type of grate employed. The radiant efficiency varies from 19 to 24 p.ct., and the aggregate may be taken at 30 p.ct. On this basis, the cost of a gas-fire will be from two to three times that of coal; and this factor, together with the general preference for the open fire, despite the labour and dirt occasioned by its use, will ensure the continued use of coal where the heating is required over long periods. But in all cases where rooms require to be rapidly heated, and kept at even temperatures for short periods, gas-fires are not only more convenient but cost less than coal-fires.

Gas-fires should, therefore, be fixed in all rooms in regular but intermittent use, and in other rooms which may be regarded as being out of commission during the winter owing to the trouble of laying and lighting a coal-fire. For bedrooms they are indispensable, as apart from the comfort of quickly obtaining warmth while dressing or undressing, they are found invaluable in cases of sickness.

The total efficiency of the best gas-fire may be taken at 80 p.ct., and 75 p.ct. of the total heat conveyed into the room is in the form of radiant energy. Their design ensures the complete removal of all products of combustion, and the adequate ventilation of the room in which they are fixed.

The annual coal allowance for domestic purposes under the Household Fuel and Lighting Order, 1918, averaged for the Northern Counties 5 tons per house or 1·1 tons per head of the population; while the free normal consumption may be taken at about 20 p.ct. more—6 tons per house or 1·32 tons per head.

Under the Coal (Pit's Mouth) Prices Order, 1919, gas undertakings had to determine the proportion of gas sold for domestic purposes as defined by the Order. Through the courtesy of the respective engineers, I have examined the returns for the principal towns in Lancashire. As would be expected, the seaside resorts show the highest percentage of sales, and the colliery districts the lowest. Excluding both extremes, the average consumption per consumer for purely domestic purposes may be taken as 20,000 c.ft. per annum.

If there is no extension of communal kitchens or laundries, and the present rapid replacement of coal by gas continues, I estimate that the gas consumption in the not remote future will reach an average of 30,000 c.ft. per consumer, which I should be disposed to regard as the economic limit for manufacturing towns under approximately present conditions; and this should displace about 18 p.ct. of coal now used for domestic purposes.

Taking as a basis a town of 100,000 inhabitants, the present purely domestic fuel consumptions are approximately 132,000 tons of coal and 444 million c.ft. of gas—requiring (say) 37,000 tons of coal. If the provisional estimate for the extended use of gas is accepted, the coal consumption would be reduced by 24,000 tons to 108,000 tons per annum, while the consumption of gas would reach 666 millions—requiring 54,000 tons, or an increase of 17,000 tons.

As evidence of the character of the demand for gas appliances, I might state that the sales in Preston during the present year have exceeded £1000 a month; and if this represents a fair average over the country, it means that consumers are providing capital for new business at the rate of £3,000,000 a year.

The demand may be expected to continue, provided the publicity efforts of the Association are maintained; and the consumer will benefit by the reduction in standing charges which will ultimately re-act on the price of gas.

For many years gas undertakings were striving to obtain a day-load to balance the heavy night lighting load; and they have been so successful that in many towns the day and night loads are equal.

To-day the need is to reduce the difference between the summer and the winter output. Some thirty years ago, the relation between these loads in Preston was 5 : 1. This was reduced to 4 : 1 during the ensuing decade, to 3 : 1 in the following period, and to-day is 2 : 1.

This is entirely due to the development of business on the domestic side, and has allowed an increase of 25 p.ct. in the sale of gas from the same manufacturing plant, which is equivalent to a reduction in the standing charges of 4d. per 1000 c.ft. on all gas sold. The more gas sold for domestic purposes the better both for the consumer and the producer; and the British Commercial Gas Association should be regarded as a valuable ally by all interested in the welfare of the public.

Mr. W. J. SWAIN, F.R.I.B.A., Architect to Messrs. Rowntrees, read a paper on

ECONOMY IN BUILDING CONSTRUCTION THROUGH THE USE OF GASEOUS FUEL.

The author said it behoves all of us to do what we can to help to solve the housing problem; and that is why he welcomes conferences such as these. The "all-gas" house will not be swallowed at once. Economy and practicability must be definitely proved before we can expect adoption. He feels convinced that, if we can faithfully prove our case, the "all-gas" house will soon find favour. When he first suggested the use of concrete for house building, it was decidedly the cheapest form of construction; but now there is little choice left from an economic standpoint. It is only by elimination that we shall economize.

Now to analyze the saving if we adopt the all-gas principle. In the ordinary cottage, the chimney breast of the living room occupies about 8 sq. ft., leaving a recess on each side. These recesses are usually converted into cupboards, and thus rob the room of something like 18 sq. ft. Similar space is wasted in the working kitchen and on the bedroom floor; while fireplaces and flues want 16 sq. ft. of room. But no space is wasted in forming flues for the all-gas house. This space is easily found in the external walls. Brick houses to-day are built with a 2-in. cavity if the external face is to be left in brick, which course is necessary if we are to have dry internal walls. If the wall is 9-in. solid brickwork, rough-cast on the external face, a brick on edge is used on both external and internal faces to form a flue 9 in. by 3 in.; hoop iron bond being employed in this case. If the walls are of solid concrete, land drain pipes cast in the thickness of the wall form an excellent flue. I have constructed these flues also in concrete slab walling, using the cavity as I would do in brick walling. I find that a flue 9 in. by 2 in. in the thickness of the wall is ample in size; and although I have used only ventilation bricks at the top of the flues near the overhang of eaves, I have experienced no trouble whatever with down-draughts. I draw my flue over from the perpendicular as I would do for an ordinary smoke flue, to safeguard against any down-draughts. If the flues open-out on an exposed position, there is no reason why they should not discharge inside the roof, which is always well ventilated; and this would prevent any chance of a down-draught.

Many cottages have even more space allotted to them for coal-fires than that which I have used; but to take the figures quoted from Earswick House at 42 sq. ft. of floor space, which to-day works out in the best examples at approximately 14s. per sq. ft., you get at once a saving on planning alone of £29 8s. Then, of course, there is a very material saving in the elimination of these costly chimney breasts and chimney stacks. An ordinary cottage, having living room, working kitchen, and three bed-rooms, built in blocks of four, requires about 21,250 bricks. Of this number, 3700 are necessary for forming the flues, &c. The cost of this brickwork, taken solid to allow for forming and pargetting the flues (to-day's price being in the region of 3s. 6d. per c.ft. for chimney construction), is £48 13s.

There is also a saving in plastering, picture rails, and skirtings. The labour of trimming the floor joists is saved, and also similar work to the roof. A lot of time and material is wasted in cutting rafters and tiles or slates, and much plumbing and lead in flashing to the chimney stack. A very moderate estimate of the saving effected by reducing the area of the house and eliminating all the construction work of flues and fireplaces is as follows:

	£	s.	d.
Saving in brickwork and labour forming flues and chimney stacks, including excavation and footings, 278 c.ft. at 3s. 6d.	48	13	0
Saving in floor area, 42 sq. ft. at 14s. per sq. ft.	29	8	0
Saving in plastering and angle bends to chimney breasts	2	10	0
Saving in trimmer joist and labour thereon, and cutting and waste to floors	3	5	0
Ditto ceiling joists	1	5	0
Saving in chimney pots and fixing	1	10	0
Saving in cutting, waste of time, and timber in forming roof around chimney stacks	1	10	0
Saving plumbers' time and material flashing to chimney stack	1	15	0
Saving in time and material, mitreing picture rail to chimney breasts	0	6	0
Ditto floor skirtings	0	6	0
Saving in forming hearths, &c.	3	10	0
	£93	18	0

We must now turn to the costs of gas appliances *v.* ordinary fitments to get at the real saving in cost. I take the figures of our costs at the Garden Village of New Earswick.

Cost of Fittings in Ordinary Construction.

	£	s.	d.
Cost of Yorkshire cottage range and fixing complete	17	10	0
Back-boiler for hot water and labour setting same	3	0	0
Labour and material, flow-and-return pipes to cylinder	2	0	0
30-gallon copper cylinder and fixing	4	10	0
Cold water supply cistern and piping, including labour fixing	3	0	0
Brick copper complete and labour setting (the flue for copper is taken in the deductions in brickwork)	5	0	0
Living room interior grate, surround and shelf, &c., material and labour setting	10	0	0
Two bedroom grates, surround and labour fixing, each	7	0	0
Total cost	£52	0	0

Cost of Fittings in the "All-Gas" House.

	£	s.	d.
Cost of gas-cooker, supply pipe, and fixing	12	0	0
Cost of gas-copper, supply pipe, and fixing	6	10	0
Cost of Parkinson's "New Cottage" water heater, to feed bath on first floor	13	10	0
N.B.—A saving on this item can be effected if bath on ground floor with open type of heater—£2 10s.			
Cost of gas-fire for sitting room, surround, and shelf	3	15	0
Cost of two gas-fires in bedrooms	4	18	6
Total cost	£40	13	6

We now find that the saving in cost per house constructed for all gas is £105 4s. 6d. These figures quoted are our net costs of

labour and material; but they would be much higher on contract work according to the costs of most of the houses being built elsewhere at the present time.

This, in itself, is good; but when we consider that over half-a-million houses are required immediately, I feel the all-gas house should receive very careful consideration by all local authorities.

Mr. Harold Bloor, B.Sc., B.Eng. (Engineer, Manager, and Secretary of the York Gas Company), read a paper, prepared by himself and Dr. Samuel Rideal, F.I.C., on

GAS FOR LIGHTING IN HOUSING SCHEMES.

In considering any aspect of the housing question, it is impossible to disregard the fact that all the "housing" under these schemes is apparently to be constructed on uneconomic lines. So far as particulars are available, it seems clear that in all towns the councils of which administer the electricity undertaking, there is a powerful leaning to electric light. Intervention of the State on behalf of electricity, also, is fraught with grave issues for the gas industry. Even apart from this, Parliament is definitely taking a larger part in national housing and industrial affairs, and must of necessity be largely guided in technical, scientific, and medical questions by the reports of "expert" committees and officials. It is therefore of the utmost importance that constant touch should be maintained with the latter, so as to secure that they shall be well and correctly informed on all matters affecting the service side of our industry (a sufficient reason in itself for the existence of this Association), and that the reports of committees should be carefully studied, and false conclusions detrimental to its interests publicly controverted.

The new unit under which gas is to be sold in future draws public attention to its real value as a source of heat. We can thus now measure gas lighting and electric lighting in terms of energy and in the same unit. A "therm" gives the consumer 100,000 B.Th.U.; and if used for lighting in an inverted incandescent burner, it should last for 4000 candle-hours. A ½-watt lamp gives 2000 candle-hours and 3400 B.Th.U.; so that two electric units give light equal to one therm of gas, with much less heat.

The greater part of the heat arising from the combustion of the gas is imparted to the air which passes through the mantles in incandescent burners; and thus the products of combustion ascend at a temperature of from 450° to 500° Fahr., producing a steady upward current velocity. This heated air occupies more than twice the volume of the cold air drawn into the burner, and weighs only half that of the incoming air. By its expansion it further assists in the room ventilation.

In the new housing schemes, the adequacy of ventilation is as important as in factories and workshops. A Departmental Committee was appointed to inquire into these work rooms of the people in 1902, and recommended that, when gas or oil is used for lighting, the proportion of carbonic acid may rise from 12 to 20 volumes per 10,000, at or about the breathing level, and away from the immediate influence of any special source of contamination, such as a person or light, except on very foggy days, when no tests should ever be made on account of the vitiated state of the atmosphere.

It follows from these recommendations that the Home Office Department do not consider the other products of gas burning as of any significance, when the ventilation is such that the quantity of carbonic acid produced is not allowed to rise above a steady state, as indicated by the above figures. It is possible from these data to ascertain the theoretical quantity of ventilation that must be provided in order that these limits may not be exceeded. As, however, normal ventilation cannot be controlled, some margin must in most cases be provided to deal with the days on which the external temperature or wind are such that the normal ventilation of the room is not obtainable. In order to ascertain at what rate the air in a bedroom or living room should be changed, it is therefore customary to take 1 c.ft. of carbonic acid gas per hour as the amount given off per person. It follows from this figure that with the outside air containing four volumes of this gas per 10,000, 1250 c.ft. of fresh air per person must be introduced into a room in order that the limit of twelve volumes per 10,000 may not be exceeded. In a room with this minimum ventilation in factories, gas may be burnt so as to increase still further the carbonic acid content, provided that at the ventilating level the content does not exceed twenty volumes.

Assuming the ventilation to be maintained at 1250 c.ft. per hour, 2 c.ft. of gas burnt per hour in a room would cause the CO_2 content to remain at 12 parts per 10,000, or produce the same effect as one person in the room; while 625 c.ft. per hour would suffice to keep the CO_2 content to a maximum of 20 parts per 10,000. A cubic foot of gas burnt without condensing the products emits (say) 450 B.Th.U.; while to heat 1250 c.ft. of air from 45° to 60° Fahr. requires only 859 B.Th.U. There is thus, with 2 c.ft. of gas burnt per hour and 1250 c.ft. of ventilation, an excess of heat available for removing the products and assisting the work of ventilation.

Gas lighting in living rooms, besides aiding the ventilation, serves another important function, inasmuch as the heated air which has passed through the incandescent mantle area is more free from organic dust particles and soot than the incoming air, which, especially in towns or crowded areas, is seldom free from these impurities. The cremating effect also ensures the death of any living organisms which may be drawn into the hot zone of the incandescent mantle. When gas lighting is used for living rooms, water vapour, and not carbonic acid, is the principal product; and so long as it remains in the air of the room the heat of vaporization is lost to the room. Thus, with gas of 500 B.Th.U. gross there are 50 units, or 10 p.ct., lost in the water vapour—making the net heating value of the gas only 450 B.Th.U.

When 2 c.ft. of gas are burnt in 1250 c.ft. of air per hour, there are produced about 750 grains of water—say ½ grain per c.ft. of air—with a rise of temperature from 45° to 60° Fahr. This is less than the quantity of water necessary to keep the relative humidity at 75 p.ct. Under average conditions hypothecated, the quantity of water added would not increase the humidity, even though the ventilation were restricted to 400 c.ft. per hour for each 2 c.ft. of gas burnt or person present.

The comparative production of CO_2 and moisture by gas and adult males respectively is shown in the following table:

Hourly Production of	1 Standard Burner 4 C.Ft. per Hour.	Three Men.
Heat in B.Th.U.	1800	1020
Moisture in grains	1581	2100
CO_2 in cubic feet	2·41	2·40

It will be observed that the quantity of moisture produced by three persons exceeds the output of an ordinary burner; while the CO_2 produced is approximately equal. CO_2 content is commonly taken as a measure of the purity of air, and its being so used under the Factory Acts has resulted in many persons, who should be better informed, confusing the indicator with the actual harmful matters which it is employed to detect.

In the course of researches in 1907, one of us found that in rooms containing over 40 parts of CO_2 per 10,000 parts of air—the CO_2 being entirely of human origin—no effects became apparent to the senses; and the health of the observers was totally unaffected. It would be a very poorly ventilated room in which 20 parts per 1000 would be found. In face of this, it is impossible to maintain the allegation that CO_2 derived from gas used for lighting living-rooms can produce any effect detrimental to health. Authorities on ventilation rightly attach much importance to the value of air currents; and gas lighting undoubtedly produces currents with beneficial effect. It is apparent that, apart from the convection through walls and ceiling due to the difference in temperature, every gas-light is equivalent to a ventilating heat engine, if some means of removing air from the top of rooms be provided. Special attention should therefore be called to the "Economy" gas-flue with which is provided a ventilation duct having openings in the room at a high level.

We conclude that an overwhelming body of human experience, backed by the testimony of every competent scientist who has investigated the matter, provides unassailable ground for the assertion that, in deciding upon the lighting medium to be employed in the new and improved housing for the people, hygienic considerations do not come into the question which we accordingly proceed to discuss: Should gas or electricity be used for lighting in the building schemes?

It must be at once admitted that the electric light is distinctly more convenient than gas. But few would be willing to accept any expense merely to provide a small point of convenience. As to decorations, the inverted burner has, of course, made a material difference to the degree of darkening of ceilings; and in rooms in which the lights can be placed at 3½ ft. to 4 ft. distance, it can be stated that, as a rule, redecorating will be required on other grounds before the state of the ceiling makes action imperative. In low rooms, however, this is not so. But there is no doubt the incentive of a "black ceiling" is a powerful spur to the housewife to have it whitewashed. It is important to observe that the ceiling darkened by gas will be at least pure pathologically, though dirty in the ordinary sense.

Lowness of the rooms has been alluded to as increasing the effects of gas on ceilings. It is more serious a factor in the case of electrically-lighted rooms, for the reason that it accentuates the harmful effects of the glare of the electric light on the eyes—important in the case of adults, but of critical importance where infants are concerned. The cheapest lamp available costs 3s. 6d. It is reasonable to suggest that the cost of renewing lamps will result in many cases in lamps being used long after they are worn out. This light will never be so good as that of an incandescent gas-burner, and will range between a dazzling but insufficient light to (in extreme cases) an entirely inadequate glimmer.

Looking, therefore, at the whole question from a broad national point of view, we advocate that in all cases where gas is available, and as a necessary consequence will be needed by every occupier for cooking and heating purposes, gas should be installed as the lighting agent.

GAS AS AN AID TO ECONOMY IN THE FACTORY AND WORKSHOP.

At the Industrial Economy Section, Alderman A. J. Hobson, LL.D., J.P., Pro. Chancellor of the Sheffield University and Chairman of the Associated Chambers of Commerce, presided.

He remarked that though the "B.C.G.A." had been formed to help the gas industry, it did not in any way limit itself to purely selfish work, and had been of great service to the nation. The gas industry had been rendered unprosperous by the high price of coal. In this, the industry had shared difficulties with the

rest of the nation. There was one point, however, in which the gas industry had been very badly treated, and that was the condition of affairs as to charges for gas throughout the war. The concerns had been unduly punished, and had not received from the public the consideration they deserved. The public had yet to learn that it did not pay to punish people who put their money into public utility services, and that the interests of the nation would suffer hereafter from the mean record that the nation had in its past treatment of tramway, telephone, and gas companies. Money would not be found for public utilities unless justice was rendered to the public who found it. In a reference to the coal strike, the Chairman said the people who believed in settlement on the basis of the common practice of giving about half what was demanded, to get the thing out of the way, were mainly people who had not sufficient knowledge of how serious the economic outlook was in this country. If the result of the strike did not bring about some moderation in the price of coal, the British steel industry was in for a desperately bad time. Some Americans were jubilant because of the steel orders they were taking in England, and because they were breaking into quite new trades in England. Those who were making it impossible to purchase goods here and were forcing purchase from America, when trade ought to go in the other direction, were pursuing a course which was detrimental to the other interests of the nation. With regard to gas in industry, he shared Dr. Saleeby's aspirations as to the use of gas to stop the smoke pall. He believed the domestic chimney was the greatest sinner, but the factory chimney contributed. If anyone could solve the problem of how gas could be used for the purpose of heating steel for manipulation, and thereby avoiding the smoke of heating and reheating furnaces, they would do a great deal towards contributing to the amenities of the health of a city like Sheffield. Owing to the quality and pressure of gas at times he had been unable to get his pots hot enough to harden files at his Sheffield works, and had been driven reluctantly to reconvert them back to coke. He had not yet again converted them to gas, because he was not quite satisfied that they had reached the period of either cheap gas or gas of reliable industrial quality. He had no word to say against the Gas Company; but they were still subject to that unintelligent interference of officials in London who knew nothing about things outside London and proceeded immediately there was a coal strike to reduce the gas to 450 B.Th.U. Until they had reached the point when they were not going to be dictated to by people in London who knew nothing about the matter, he was not going to reconvert his plant. It was not prejudice against gas, but against the continuance of that ignorant Government control of which they must rid themselves before it strangled them.

The following papers were submitted by Mr. S. T. S. Musgrove, Dr. C. M. Walter, Mr. B. W. Brooks, Mr. A. B. Roxburgh, and Mr. E. W. L. Nicol.

INDUSTRIAL USE OF TOWN GAS IN SHEFFIELD.

By S. T. S. Musgrove.

In Sheffield, town gas as a fuel is now generally recognized as a most desirable heating agent for industrial uses. Gas-fired furnaces are to-day being employed for a multiplicity of purposes. During the war, when the demand was urgent and output was a matter of life and death, the universality of town gas for heating processes was realized; and, unlike most of the war-time expedients, its utility has not diminished since the return of peace. On the contrary, its value has been emphasized; its possibilities have been made more widely known; and its adaptability has become generally appreciated.

In these critical days, when manufacturers are confronted with the difficult problems of production, there could be no subject of greater interest, both to the user and the supplier, than industrial gas appliances. In Sheffield, although a large range of standard gas-fired furnaces are in constant daily use for manifold purposes, only the fringe of the subject has been touched. When one remembers the numerous special furnaces which have been designed and put to work, the great possibilities of town gas as a fuel for industrial heating becomes apparent. Although this side of the subject is full of interest, it is impossible to deal with it on this occasion—the time available allows only a brief description of one or two typical gas-fired furnaces specially suitable for the Sheffield trades. It could, I think, be claimed without fear of contradiction that town gas as a fuel is indispensable to the Sheffield industries.

Sheffield Type Gas and Air-Blast Furnaces.

For heating blanks for drop stamping, rolling, and forging in the cutlery and other light trades of Sheffield, a furnace specially designed by the Sheffield Gas Company for the requirements of the industry is in general use. It is simple in construction, easy to control, and economical in operation. For repetition work, where output is a vital factor, this furnace is particularly suitable. It is fitted with burners which ensure rapidity of heating, which, for this class of work, is of even more importance than economy. It will be readily understood that in these days of short working hours, it is most essential that the machine (power hammer, drop stamp, &c.) should be continually kept at work; otherwise the loss entailed is far more serious than the extra consumption of gas.

The following figures showing the consumption of gas under various conditions, are typical of this type of furnace.

Gas Consumption of Gas and Air-Blast Furnaces.

Interior dimensions 9 in. deep by 12 in. wide by 6 in. high.
Gas pressure at the inlet to the burners, 25-10ths.
Air pressure at the inlet to the burners, 1½ lbs.

Empty Furnace.

Gas consumption to raise empty furnace from cold to 1000° C.—42 c.ft.
Gas consumption to raise empty furnace from cold to 1250° C. (only required occasionally)—150 c.ft.
Time occupied to raise empty furnace from cold to 1000° C.—7 minutes.
Time occupied to raise empty furnace from cold to 1250° C.—25 minutes.

Heating the Ends of $\frac{7}{8}$ in. by $\frac{5}{16}$ in. Iron Bars to Forging Temperature.

Test No. 1.

Furnace Cold.

Weight of each end actually heated, 2 lbs.
Number of ends heated, 50.
Total weight actually heated, 100 lbs.
Temperature, 950° C.
Total gas consumption, 210 c.ft.
Consumption per pound of iron actually heated, 2·1 c.ft.

Test No. 2.

Furnace Hot.

Weight of each end actually heated, 2 lbs.
Number of ends heated, 100.
Total weight of metal heated, 200 lbs.
Temperature, 1050° C.
Total gas consumption, 360 c.ft.
Consumption per pound actually heated, 1·8 c.ft.

Total gas consumption during tests 1 and 2, 570 c.ft.
Total weight of metal heated, 300 lbs.
Temperature (mean), 1000° C.
Consumption per pound metal heated, 1·9 c.ft.

Test No. 3.

Furnace Cold.

Weight of each end actually heated, 2 lbs.
Number of ends heated, 50.
Total weight of metal heated, 100 lbs.
Temperature, 1100° C.
Total gas consumption, 265 c.ft.
Consumption per pound metal heated, 2·65 c.ft.

Test No. 4.

Furnace Hot.

Weight of each end actually heated, 2 lbs.
Number of ends, 100.
Total weight of metal heated, 200 lbs.
Total gas consumption, 441 c.ft.
Temperature, 1100° C.
Consumption per pound metal heated, 2·2 c.ft.

Total gas consumption during tests 3 and 4, 706 c.ft.
Weight of metal heated, 300 lbs.
Temperature (mean), 1075° C.
Consumption per pound metal heated, 2·35 c.ft.

F. & A. R. Type Furnace.

This is a furnace extensively used in Sheffield for the heating of bulky articles for forging, rolling, and stamping. It is on entirely new lines, and has been specially designed to meet an insistent demand for an economical furnace at moderate cost. The furnace is provided with two sets of recuperators—one set being built under the floor of the furnace and the other set between the arch and the top of the furnace. They are so arranged that when the furnace is working, one set of recuperators under the floor and one set above the arch absorb the heat from the hot waste gases, while the other recuperators transfer to the incoming air the heat already absorbed. By this arrangement the capacity of the recuperators is materially increased, and the maximum amount of heat is extracted from the flue gases. The recuperators underneath are connected with the recuperators above the floor by a cavity extending the whole depth of the furnace built in each side wall. The latter is, therefore, efficiently insulated, and radiation losses of the furnace are reduced to a minimum. The design is such that not only is a given temperature maintained in the working chamber at a greatly reduced gas consumption, but at the same time the heat from the furnace is prevented from causing discomfort to the operator. The furnace is fired alternately on either side, and the distribution of heat in the working oven is thereby absolutely uniform. It is strongly and robustly built; and the floor is amply supported, and will stand heavy weights and rough usage at a minimum cost for maintenance. With gas at a normal pressure and the air at a few inches water-gauge—obtained by means of a small fan—a forging temperature can be quickly reached and easily maintained.

One of the features of the furnace is that, even if the operator neglected to reverse the furnace—which is always a possible contingency, especially when, as is usual, he is working on a basis of payment according to output—it is still regenerative in action and economical in operation, because, under all conditions of working, the flues conveying air to the furnace alternate with the flues carrying the hot products of combustion from the furnace and the heat from the latter is transferred to the air and brought back to the furnace.

The following figures show the gas consumption of this type of furnace maintaining the empty oven at a given temperature:

Starting from Cold.

—	Temperature Maintained 900° C.	Temperature Maintained 1100° C.
Interior dimensions	6 ft. × 2 ft. × 1 ft.	6 ft. × 2 ft. × 1 ft.
Area of internal walls	54 sq. ft.	54 sq. ft.
Duration of test	8 hours	8 hours.
Total gas consumption	4480 c.ft.	5520 c.ft.
Gas consumption per hour	560 c.ft.	690 c.ft.

Although the actual rate per hour to maintain the furnace at a temperature of 900° and 1100° C. is 560 and 690 c.ft. respectively, the actual gas rate during the last two hours was only 288 c.ft. to maintain a temperature of 900° C., and 620 c.ft. to maintain a temperature of 1100° C. Therefore, the gas required per square foot of internal area to maintain the empty furnace at 900° and 1100° C. is 7·2 and 11·5 c.ft. respectively.

"Rotoflam" Furnace.

For hardening expensive high-speed steel cutters, dies, forming tools, &c., which is a delicate and very highly-skilled operation, not only on account of the high temperature (1250° C.) that is required, but because a reject at the hardening stage of manufacture can easily involve very considerable losses, a solid-fuel furnace would be useless, as the evenness of heat essential could not be obtained. In Sheffield, a special gas and air-blast furnace is used. The furnace has a heating chamber circular in section, and the burners are fitted at the top and bottom, so that the flames spiral round the walls of the oven and—a most important point—cannot therefore impinge on the work being treated. The most delicate and intricate tool can be hardened in safety in this furnace and without any fear of local burning. The average consumption of gas to maintain the desired temperature is approximately 400 c.ft. per hour. In order to heat the tool at a comparatively slow rate to a temperature of about 950° C., the natural-draught oven furnace is used in conjunction with the special gas and air-blast furnace.

The cost of the finished article must always be a constant concern of the enterprising manufacturer; and he is quick to take advantage of any apparatus which can be shown to increase production or reduce working costs. As an illustration of this fact, one example only need be given. Repeat orders for the automatic clockwork gas controller are already coming in, although their application to gas-furnace lighting is a comparatively recent development, and, as far as we know, one that has not been generally adopted. The arrangement is proving exceptionally reliable. Before its introduction by the gas company, in order to prevent furnace operators wasting time in the morning waiting for the furnace to reach the required temperature for the first heat, it was necessary for a man to commence work some considerable time before the usual starting hour to light-up the furnace. By fixing an automatic lighting device, a furnace can be lighted-up at any predetermined hour with practically no cost.

A list of gas-furnaces installed by the Sheffield Gas Company during the last few months shows an approximate gas consumption of 27,685 c.ft. per hour, and 221,480 c.ft. per working day of eight hours.

INDUSTRIAL HEATING WITH TOWN GAS IN BIRMINGHAM.

By Dr. C. M. Walter.

In Birmingham, for the year ended March 31, 1913, the total gas supplied amounted to 9,164,962,000 c.ft., and the corresponding industrial heating load to 609,424,800, or 6·66 p.ct. of the total output. For the year ended March 31, 1919, the total gas supplied for all purposes amounted to 11,984,263,000 c.ft.; the corresponding amount for industrial heating being 2,522,338,600 c.ft., or 21·04 p.ct. of the total output.

Generally speaking, in dealing with propositions of an industrial nature, the policy of the department has been to approach manufacturers in a very practical way by inviting them to inspect the various types of furnaces in the heat-treatment shops and foundries specially equipped for the purpose. In these shops, which are staffed with experts on the heat-treatment of ferrous and non-ferrous metals, and which are being run continually on production lines, most of the standard types of furnaces and heating apparatus can be seen, and full-scale tests arranged with the manufacturers' own material if necessary. Further, a complete equipment of large coke-fired furnaces is installed, so that every facility is offered both to the department and to the consumer to ascertain whether or not town gas may be considered as a sound and practical proposition in any particular application of industrial heating. Should it be found, as a result of extensive tests, that town gas cannot compete with other forms of fuel, the interested prospective consumer is acquainted with the fact, and advised as to the form of fuel which he should adopt.

The policy outlined above is one which has been adopted by the Birmingham Gas Department since 1911, when the development of town gas as an industrial fuel appealed to the department as a subject requiring very close consideration, with the result that a special department for investigating industrial heating problems was established. From that time to the present, the department has gradually extended its activities to cope with the increased demands of the manufacturing establishments of the city; and at the present time it includes a complete suite of laboratories, in which the many and varied problems of manufacturers can be fully investigated.

As is generally known, part of the distributing system of the department includes a boosting system of upwards of 20 miles of high-pressure mains carrying gas at a pressure of about 12 lbs. per sq. in. During the last six years, a considerable number of manufacturers who were fortunate enough to be on the route of these mains have taken supplies at full pressure, chiefly in connection with metal melting; and while the speed of melting such metals as brass, bronze, and aluminium by means of high-pressure gas with atmospheric burners is perhaps not so great as may be obtained with systems using burners of the air-blast type, the total costs of melting by the former method, taking into account maintenance costs, is found to be considerably less than those obtained when the latter method is employed. I would here especially mention the application of high-pressure gas in connection with the melting of aluminium and aluminium alloys, both for sand casting and die casting, which has always resulted in most satisfactory results being obtained.

High-pressure gas is also being used very extensively in connection with the heating of tinmen's stoves; and to-day many hundreds of such stoves supplied with gas at a pressure of 3 lbs. to 5 lbs. per sq. in. are found in the various tin shops of the city. The gas consumption of these appliances amounts to approximately 12 c.ft. per hour per stove, as compared with 17 c.ft. to 20 c.ft. per hour when low-pressure gas is employed. Other industrial heating plants employing gas at high pressure include glass-melting tanks, glory holes, japanning and lacquering stoves, ceramic firing kilns, and lead and solder melting pots.

Muffle and Oven Furnaces.

The demand for gas-furnaces for such purposes as annealing, reheating, carburizing, and general heat treatment of metals continues to increase, and owing to the huge strides that have been made during the last few years, which have resulted in some instances in the efficiency of such apparatus being practically doubled, gas undertakings are now in a position to exploit new fields, in which, in the past, town gas was unable to compete with other forms of fuel. The increased efficiencies referred to are to a great extent the result of the principle of recuperation being applied to the town gas-fired furnaces; and although this principle of heat recovery dates back as early as 1860, when it was employed by Sir William Siemens to obtain the high temperatures required for steel smelting, its application to furnaces using town gas has received but little consideration until the last few years, when the Davis Furnace Company, of Luton, carried out a considerable amount of experimental work, which resulted in the adoption of recuperative principles in connection with oven furnaces fired by high-grade gas.

In considering the possibilities of the recuperator furnace, the author does not wish to suggest that this type of furnace will replace the direct-fired furnace in every instance. The former type of furnace, while being ideal in cases where the working temperature is high, and the heating process a continuous one, would, in many instances, not be justified for use for annealing, reheating, and other similar processes when only intermittent heating for short periods is necessary.

In a large number of cases a small direct-fired furnace, in which the secondary air is pre-heated by passing through flues arranged in the bed of the furnace, is found to give very satisfactory results; while at the same time its use does not involve a large capital outlay. Although such a system is by no means the most economical from the point of view of fuel economy, nevertheless, from a consideration of the first cost, simplicity of manipulation, ease of control, and speed of heating-up to any required temperature up to (say) 900° C., it is found to compete favourably with many other types of furnaces in which recuperatory systems are employed.

In operations where the period of heating is extended over several hours, and also where the furnaces employed are larger in dimensions, the direct-fired furnace with a counter-current system of recuperative setting may be employed with advantage. With such a design, the secondary air is preheated by means of the waste gases which, of course, leads to a considerable increase in fuel efficiency, but at the same time entails increased capital outlay. Further, in furnaces of this type, the period required for heating-up to the requisite temperature is much longer than in the case of the direct-fired furnace referred to above, owing to the increased mass of brickwork which is necessary in the construction of their recuperative settings. It will thus be seen that the most suitable design of furnace for a given operation of heating must depend in the first place on the working temperature; secondly, on the time during which the operation lasts; and, finally, on the size of the furnace that is required. As regards fuel consumption in the case of the direct-fired furnace in which the pre-heating of the air is not carried out by waste gases, it is found that for each square foot of interior heating surface of oven employed, about 11,000 B.Th.U. per hour are required for heating-up to a temperature of about 800° C. in one hour; the consumption for maintaining at this temperature under load approximating to 4500 B.Th.U. per hour per sq. ft. of heating surface.

Where a furnace fitted with recuperators is employed in which the secondary air used for combustion is pre-heated by means of the waste gases, a saving of fuel of as much as 35 to 40 p.ct. can

be effected in the complete operation of heating-up the load and maintaining it at some pre-determined temperature.

That the future development of the gas-heated furnace will, to a great extent, depend on more complete recuperation of waste heat, I think there can be no doubt. Full efficiencies of direct-fired furnaces will undoubtedly be increased by the employment of organs of recuperation such as pre-heating chambers, water-heaters, and steam generators. The high efficiencies now obtainable with recuperator type furnaces will, with a more complete knowledge of recuperation as applied to the combustion of high-grade gases, be still further augmented, and the fields of application of gas as an industrial fuel will thus without doubt be greatly extended.

Our experience during the last ten years has shown that collaboration between furnace maker and gas supplier is essential for the extension of an industrial load on sound principles; and while it could not be expected to be within the province of every gas undertaking in manufacturing areas to equip large demonstration rooms with most of the modern types of industrial heating apparatus, nevertheless, it would seem that co-operative effort would go a very long way in providing the consumer with the most efficient apparatus; and this would appear to offer tremendous scope for the British Commercial Gas Association to do a great service to the industry generally.

INDUSTRIAL GAS INSTALLATIONS IN LONDON.

By B. W. BROOKS, the Industrial Fuel Expert to the Gas Light and Coke Company.

Great strides have been made during recent years with the design of gas-heated apparatus, with the result that standards have been reached which enable gas to be used in large quantities for process work which was formerly done by solid fuel. There is, however, still plenty of spade-work to be done; and it is surprising when one inquires into the uses to which gas can be put to find what a number of trade processes there are which, up to the present, have received scant attention.

Each trade should therefore be thoroughly investigated, and records made of the opportunities that exist for the application of gas. It will be found in many cases that no standard pattern appliances are available for certain classes of work, and that it is necessary to carry-out experiments and tests to determine the most suitable form of appliance to recommend. Information obtained in this way enables one to approach manufacturers and place propositions before them with confidence and success; and it is really surprising to find how willing people are to listen when you have something definite and specific to talk about. When a new piece of apparatus has been produced, and its suitability for its purpose proved, the method of bringing the matter to the notice of possible customers is to publish illustrations and data in "A Thousand-and-One Uses for Gas," and then give all such potential customers an early call and endeavour to arrange for a demonstration. There are few problems concerned with the application of heat for manufacturing purposes which, given thought, care, and patience, gas cannot solve to the satisfaction of the user and to the benefit of the public.

This statement the author supports by an interesting set of illustrations, which show various novel uses of gas in industrial processes. Among others are specially designed gas-heated appliances for drying glass bottles after they have been washed, for drying cast-iron pieces after they have been electro tin-plated, for recovering solder from old petrol cans, and for heating moulds employed in the manufacture of models used for displaying goods in shop-windows. In all these cases, as Mr. Brooks points out, no standard pattern appliances were available. It was necessary, therefore, to design special appliances and to carry out tests in order to ascertain the most suitable methods of obtaining the desired result.

GAS AS AN AID TO ECONOMY IN INDUSTRIAL PROCESSES AT NEWCASTLE-UPON-TYNE.

By A. B. ROXBURGH.

The author gave details of the results of some of the activities of the gas undertaking in Newcastle-upon-Tyne. In most cases, the apparatus has been designed by the company, and either built by their workmen or constructed by the users' employees under the company's supervision. The necessity for the special designs has generally arisen from the absence of anything already designed for the specific purpose; or the cost of furnaces of standard pattern rendering adoption by small manufacturers prohibitive.

For the size of Newcastle-upon-Tyne and its adjacent towns within the area of supply of the Newcastle and Gateshead Gas Company, there are surprisingly few industries; Newcastle being really the commercial centre of a large coal-mining district. As an example, the name of Newcastle is almost synonymous with shipbuilding; and yet in the portion of Newcastle within the Gas Company's area of supply, there is not a single shipyard. True, there are four shipyards in their territory in other districts; but of these, three are very small ones, newly started. There is some gratification in stating that in all these three, coal gas is the sole source of light, heat, and power. There are large and important works, of course; but for the size of the district and the number of its inhabitants, they are comparatively few. Still, a good deal has been achieved; and every case has been treated according to the requirements of the user.

Locally, at any rate, the circumstances regarding the use of a gaseous fuel are entirely altered in comparison with pre-war times. Hard fuel and labour have advanced in cost nearly three to one, while coal gas at the prices at present charged has advanced less than 10 p.ct. So that what might not have been commercially possible before the war is now not only possible, but economically imperative. Labour—such a costly item at present, and not likely to be much cheaper in the near future—is inseparable from the use of hard fuel; and this item alone will often determine that coal gas shall be adopted, its use necessitating the employment of no labour other than that attendant upon the articles to be treated. There are many jobs where the total costs with coal gas do not amount to the labour costs only where hard fuel is used.

Among the selection of twenty-seven—only a small proportion of the total—instances in which gas has been adapted to industrial purposes in Newcastle, one had relation to the bending of bars. In this particular case, a solid-fuel fire for heating the bars was replaced by a gas-furnace; and the total cost of the gas was less than that of the men's time spent in lighting the hard-fuel fire. Gas is being used for supplying steam for presses in the hosiery trade, and for syrup pans in breweries, for de-hydrating Epsom salts, for cutting-off electric lamp bulbs, for core-drying, firing stained glass, forging, enamelling parts of motor cars, and for commercial bread-baking. It is used for drying bird sand; and it is even required by canary breeders to improve the singing of the birds.

Gas has been adopted by manufacturers after careful trial, because of its reliability, ease of manipulation and control, cleanliness, rapidity of action, and economy, as evidenced by lower fuel bills and the saving of labour and factory floor-space.

GAS COKE IN RELATION TO CHEAP POWER AND SMOKE ABATEMENT.

By E. W. L. NICOL, Fuel Expert to the London Coke Committee.

In his paper, the author gave a *résumé* of the work accomplished by the London Coke Committee. It has, the author said, been pointed out that it is not so much by reducing our total coal consumption that progress will be made in the future development of British industries. The home consumption of industrial coal is, in fact, an accurate index of industrial activity; but true progress in fuel economy will be made only by increasing the industrial output for a given coal consumption—thus reserving for export a larger margin of our total coal production. This desirable, and, indeed, essential object, may be promoted by improving the efficiency of industrial methods and machines, and by improving the thermal efficiency of fuel consuming plant and processes. There is, however, another important and immediately available way in which output for a given coal consumption may be improved very materially. This way is by increasing fuel efficiency through promoting the rational use of coal, not merely as fuel, but as a raw material for the manufacture of fuels—solid, liquid, and gaseous—each capable of being consumed smokelessly, and possessing collectively and individually a much higher "availability," or efficiency, than the coal from which they are produced by the process of carbonization; and it is with the possibilities of this latter aspect of the problem that he is more immediately concerned. Thanks to the educational propaganda methods and apparatus adopted from the outset by the London Coke Committee, many steam users and electrical engineers are now numbered among the best friends of the gas industry.

On the other hand, owing to the stabilized market thus created for coke and a fuller appreciation and realization of its economic and commercial value by both the user and gas supply authority, coke is more than ever the chief ally of gas, from both the practical and national view-points. Its increasing importance as a factor bearing upon national economy, upon the efficiency of industrial and domestic heating, and upon the public health and welfare, due to the elimination of smoke, tends, in fact, to render the moral obligation to supply coke second only to the statutory obligation to supply gas.

The introduction of coke in lieu of coal, and of modern coke-burning appliances, by the London Coke Committee has raised many hand-fired steam plants to a relatively high degree of thermal efficiency, and their attendants to a position of relative comfort and freedom from the unwelcome and often unpractical attention of the smoke inspector. Some 500 sets of apparatus, each capable of consuming 500 tons of coke per annum, have been made and fixed to hand-fired boiler-furnaces, with a view to enable steam-users to eliminate entirely the use of crude coal. Incidental advantages realized, in addition to the total elimination of visible smoke, are increased steaming capacity and output of finished products, as well as very substantial financial savings due largely to higher calorific efficiency obtained when coke is fired on rational lines. Few have reverted to the use of coal; and the re-introduction of coal is, in fact, opposed by many engineers and boiler attendants after their experience with coke.

A recent invention which facilitates the cleaning of hand-fired urnaces and prevents loss of fuel and steam pressure during the operation, should tend materially to improve the average efficiency obtained, and, incidentally, facilitate the use of coke for boiler-firing. A very serious disadvantage of the mechanical stoker is its inherent limitation to bituminous coal. Steam users

whose boilers are so equipped are unable to take full advantage of relatively cheap coke or breeze, however plentiful or cheap, or to realize the bargaining advantage of an alternative fuel.

Electric power stations almost invariably are equipped with water-tube boilers and chain-grate stokers. This type of stoker is, like most others, designed on a bituminous coal basis, and is, ordinarily, quite unsuitable for use with coke, or even any considerable admixture of coke with coal. Early in 1913 the author was, however, able to institute experiments at an important power station in Yorkshire, with a view to adapting the chain-grate mechanical stoker to use coke and coal slack. Admixtures of coke up to 75 p.ct. were used quite satisfactorily with very inferior coal slack. The full evaporative capacity of the boiler was maintained under ordinary conditions of natural draught, and a marked improvement in efficiency was noted. The adaptation was an extremely simple one; the feed hopper being merely divided so that the coke and coal were fed, or "sandwiched," on to the moving grate in well-defined super-imposed layers—the coal layer being uppermost.

Known as the "Sandwich System," this invention has since been adopted as a permanent institution at some of the largest power stations in London. It has been the means of opening-up important business relations with public utility undertakings, public authorities, and large power users. Three or four of these undertakings in London, whose boilers are only partially equipped with the "Sandwich System," are already consuming over 100,000 tons of coke per annum.

Applicable to the largest capacity water-tube boilers, the "Sandwich System" of blending bituminous coal with gas coke is an invention possessing considerable potentiality, not only from the business promoting point of view, but also from the aspects of national economy in fuel and the improvement of atmospheric conditions, by mitigating the smoke nuisance. At power stations having more than one chimney, it is very interesting to note the total absence of visible smoke from the chimneys under which the "Sandwich System" of boiler firing is in use, contrasting with the smoke emitted from those over ordinary coal-fired boilers.

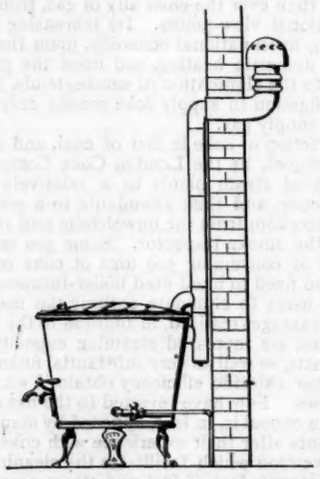
Eminent electrical engineers have not been slow to recognize indirectly, but none the less magnanimously, the good work accomplished by the London Coke Committee. The author cited the case of the Greenwich generating station. Here, with the "Sandwich System," low-grade coal slack, practically useless for any other than direct fuel purposes, and often considered unsaleable, is now used, blended with graded coke, efficiently and smokelessly, in place of the higher grades of coal, which are thus released for export.

By encouraging the manufacture of the most efficient coke-consuming domestic apparatus, and by informing the public as to their use and advantages, the London Coke Committee have also been promoting the mitigation of the domestic smoke nuisance.

[The papers read by Prof. J. W. Cobb, C.B.E., B.Sc., F.I.C., and Prof. A. H. Barker, Whitworth Scholar, B.A., B.Sc., and the report of the remainder of the proceedings are held over.]

THE "ROVENTA" COWL.

FOR some considerable time there has been a demand for a reliable and durable ventilating cowl in place of the more common sheet-iron ones, which were far from satisfactory, not only as regards the working of them, but also their life. It was to meet this urgent need that the "Roventa" cowl was designed. It is particularly useful for fixing upon the outlet flues of gas-consuming appliances.



A Gas Wash-Boiler fitted with a "Roventa" Cowl on the Flue Pipe.

It is intended to replace the sheet-iron flue terminations now used in various forms, such as T or H pieces, or as are more frequently used, sheet-iron elbows with a cone on top. The sheet-iron devices almost universally used in the past cannot be relied upon to remove effectually the products of combustion from the appliances to which they are connected, and frequently allow down-draught—in many instances a positive source of danger. Not only do they fail in these respects; but they are of such a character as to deteriorate rapidly, and in a very short time are blown from their positions, with the attendant risks of accidents to persons and property.

The principle on which the "Roventa" cowl is designed prevents the direct action of the wind from entering the flue-pipe proper, and diverts the wind pressure in such a manner as to assist the exhaust of foul gases. The "Roventa" cowl is always in action, under every condition of weather, irrespective of the pressure or direction of the wind acting on the cowl. It will withstand rain or snow; it contains nothing mechanical to get out of order, and when fixed requires no attention.

The cowl is manufactured in light cast iron, cast aluminium, and also in earthenware.

The latter type will be found particularly useful in fixing to gas-fire flues where built in the walls of buildings. Where flues from gas-fires, water-heaters, &c., are connected to the ordinary chimney flues in houses, and down-draught is experienced, the fixing of an earthenware "Roventa" cowl in place of the usual chimney pot is said effectually to prevent down-draught in the flues, ensure ventilation, and remove the products of combustion from the apparatus.

Some hundreds of these cowls have now been in use with every success for upwards of twelve months; and they have been officially recommended by the Ministry of Health (Housing), for fixing on the outlets of gas-fire flues and other gas apparatus.

Tar Gas and Furnace Fuel.

In their "News from the Antipodes," under date of Sydney, Aug. 28, the "Chemical Trade Journal" publishes the following: In view of the general shortage of coal, and the frequent recurrence of industrial inertia due to the difficulty of obtaining supplies of that commodity, considerable interest is being manifested by manufacturers and others in a process for reducing liquid tar to a gas-like form for use in "feeding" furnaces. By means of an ingenious contrivance, known as an "S.W.D." burner, the particles of tar are not merely turned to spray, but are gasified, and afterwards blown into the furnace or under the boiler, as the case may be. To prevent clogging, the "S.W.D." is super-saturated with oxygen from the air; and consequently it can be burned without producing smoke or soot.

A Moderate Calorific Standard in Canada.

By request, Mr. Arthur Hewitt, of the Toronto Gas Consumers' Company, has repeated, in the "American Gas Association Monthly," the reasons for his conviction that, so far as ordinary domestic apparatus is concerned, there would be little (if any) more gas used if the calorific value of the gas were "reasonably low" than would be the case with gas of a higher calorific value. A minimum calorific standard of 450 B.Th.U. was fixed by the Canadian Government as a temporary measure in November, 1919, and was to be continued for a period of four months. This standard was the more readily approved because of the difficulty of securing coal and oil for the manufacture of gas, and of the great necessity, from a national point of view, of conserving these raw materials to the utmost possible extent. It was, of course, not practicable for gas companies satisfactorily to readjust their methods and operations to a new standard, unless they could anticipate for it a degree of permanence. This fact was pointed out to the Government; and as there had in the meantime been no improvement in the situation regarding coal and oil, the limit of time for the new standard was removed, and for it was substituted "until further notice." Results realized so far have been most satisfactory to all interests concerned. While the prices of coal, oil, and all other raw materials and supplies used by gas companies have advanced over pre-war rates from 200 to 400 p.ct., and labour costs have risen over 100 p.ct., the price paid by consumers for gas has been advanced by only a fraction of these figures. Had the Canadian gas companies not been able to effect economies in manufacture, there can be no question but that the price of gas must have been increased enormously beyond the present levels. The saving has been entirely to the advantage of the gas consumers. Comparative figures given for April, 1918, and April, 1920, show that in practice there has not been any appreciable increase in the monthly quantities of gas used by consumers since the reduction in the average calorific value from 537 to 492 B.Th.U.

Reviving Optimism.—Says the "American Gas Engineering Journal:" Of recent times, it has not been an especially inspiring task to be a toiler in the gas industry. Most industries have experienced some anxieties, worries, and perplexities; but to the harassed gas man it has seemed that his industry has had them all. It seemed that a treadmill spirit had seized the whole gas industry. It was simply a case of struggling on till even struggling would not achieve an existence. But we see here and there a gleam of new interest. People begin to talk of new business and bigger things. Is it merely a case of the occasional gleam of sunshine in a clouded sky, or does it presage better times—times in which we may at least entertain hopes—for the gas industry?

WALES AND MONMOUTHSHIRE DISTRICT INSTITUTION OF GAS ENGINEERS AND MANAGERS.

Half-Yearly General Meeting at Newport.

DISTURBED conditions did not prevent a very good attendance at last Thursday's meeting of the Institution, which was held at Newport, the home of the new President, Mr. J. HERBERT CANNING, O.B.E., F.C.S., Engineer and General Manager of the Gas Company there. It was, of course, not the Institution's first visit to Newport, nor was it Mr. Canning's first occupation of the Presidential Chair; and memories of what had gone before doubtless exercised their influence in the direction of providing so gratifying a muster. At the outset, Mr. A. J. BOND, of Aberavon, the outgoing President, was in the chair. The technical business—consisting of Mr. Canning's Inaugural Address and a topical paper by Mr. James Robb, of Chepstow—profitably occupied the morning; while success for the remainder of the day's programme was assured by the hospitality of the Chairman and Directors of the Newport Gas Company.

The meeting was held in the Gas Offices, and was prefaced by a welcome on behalf of the Institution's hosts.

Mr. A. J. BOND, of Aberavon, on taking the chair, said that, before proceeding to the agenda, he would like to introduce to the members Sir Garrod Thomas, one of the Directors of the Newport Gas Company, who was present. They were very gratified to see him giving up his time to the Institution in this way, and offered him a hearty welcome. It was always pleasing to see Directors taking an active interest in supporting members of the gas industry at meetings such as these.

Sir GARROD THOMAS said he felt that it was he who should welcome the members to the room—and he did so most heartily—as he happened at the moment to be the only Director of the Newport Gas Company present. He hoped the meeting would be a successful one, and that among the technical business the social side of the programme would not be altogether forgotten. In the troublous times through which they were now passing, interchange of ideas should lead to the more successful working of all undertakings. They were also in the midst of competition; but there was plenty of room for their competitors, as well as for themselves. He was quite sure that gas had a function to perform, and that there was a future for the industry which nothing they knew of at present was likely to take away from it.

MINUTES OF THE LAST MEETING.

The HON. SECRETARY (Mr. Octavius Thomas, of Pentre) read the minutes of the last meeting, held at Brecon; and they were confirmed. He also intimated the receipt of a number of apologies for absence.

NEW MEMBERS.

On the proposition of Mr. D. J. DAVIES (Haverfordwest), seconded by Mr. F. SHEWRING (Pontardawe), the following were elected: Members—Mr. J. D. Hester (Bridgend) and Mr. C. A. Lawton (Milford Haven). Student—Mr. T. A. Canning (Newport).

AN HONORARY MEMBER.

Mr. J. H. CANNING said it was with the greatest pleasure he rose to propose the election of Mr. T. H. Hazell, of Newport, as an honorary member, as recommended by the Council, for valuable services rendered to the Institution. He regarded it as a privilege to make this proposal, in view of the lifelong friendship that had existed between Mr. Hazell and his (Mr. Canning's) father and himself. The Institution had not hitherto exercised their power to elect an honorary member; and he certainly thought they could not make a better beginning. In the first place, they all knew of Mr. Hazell's long connection with the Newport Gas Company, where he was held in the highest esteem, and even affection, by the Directors, staff, and workmen. He had shown the greatest ability in the whole of the work he had accomplished for the Company. Secondly, he would like to refer to Mr. Hazell's great services as a citizen of the borough. For many years he had sat upon the School Board, where he had done everything possible to see that the ratepayers' money was spent economically and efficiently. He had also been long connected with the local Chamber of Commerce, who had recently done him the honour of electing him their President. There were numerous other bodies with which he was connected. The last reason for his election was the most weighty one so far as the members were concerned—namely, the uniform friendship and kindness that Mr. Hazell had shown towards the Institution from its inception to the present time. He had supported them in every way, and had taken endless trouble in endeavouring to make the meetings successful—including the present one.

Mr. J. E. KENSHOLE (Merthyr), in seconding, said that he knew of no one better fitted than Mr. Hazell to be an honorary member of the Institution.

Mr. BOND paid a tribute of respect to Mr. Hazell, whose great services to the Institution were acknowledged by Messrs. A. E. DAVEY (Aberdare), H. D. MADDEN (Cardiff), and J. ROBB (Chepstow); and the proposition was carried by acclamation.

Mr. HAZELL, in acknowledgment, said he felt that he ought to apologize for the fact that so much of the time of the meeting had been devoted to himself. He scarcely recognized himself in most of the flattering remarks that had been made; but he did appreciate the kind feeling that had instigated the honour which had been conferred upon him. Whatever he had done in the past he would be happy to do in the future to advance their general interests.

THE NEW PRESIDENT.

Mr. BOND, in asking Mr. Canning to take the chair, said they all knew the sterling worth of that gentleman, and the excellence of the work he had done for the Institution. His late revered father before him took the same interest in their affairs as his son was doing. Mr. Canning held an honoured position, not only in their Institution, but throughout the whole industry. This was not the first time that he had been elected President; but since the last occasion they had passed through troublous days indeed. During the war, Mr. Canning filled an important position with the Munitions Department, in connection with the production of toluol and benzole; and those of them who made use of his services knew that whatever information they desired would be most readily given.

Mr. J. H. CANNING, who, on taking the chair, met with a cordial reception, said it was certainly true that he would always have at heart the interests of the industry in general and of their Institution, and would do his best to promote them in every way. With regard to what was done during the war, he might say that very little would have been effected in their district, or indeed anywhere in the country, without the active co-operation of all the members of the industry; and he would like to make recognition of the great assistance he obtained in his work from everybody connected with the industry. Without exception, all did everything they could in the national interests. He was very much afraid they none of them received encouragement from the Government; but, still, they had the satisfaction of feeling that they did their duty to the country—and did it in extremely difficult circumstances. His first duty was to propose a hearty vote of thanks to the retiring President, Mr. Bond, for the admirable manner in which he had carried out the duties of his office. He was an old friend who had been in the district for a great number of years. During his presidency he had taken action on many occasions which had materially assisted the industry. One matter to which he would like to refer in particular was the valuable evidence that Mr. Bond laid before the Regional Committee of the Ministry of Health in favour of the claims of gas from hygienic, labour-saving, and other points of view.

Mr. W. H. JOHNS (Swansea) seconded the vote of thanks, which was heartily accorded, and briefly acknowledged by Mr. BOND.

Mr. CANNING then proceeded to deliver the following

PRESIDENTIAL ADDRESS.

Gentlemen,—I must express to you my hearty thanks for the very great honour you have conferred upon me in again electing me to the presidency of your Institution. Ten years have elapsed since I had the privilege of addressing you from the presidential chair; and few could have foreseen on that occasion that the immediate future was to prove so eventful and so fraught with peril. The history of our industry for the past six years has been so painfully and so indelibly engraved on the memories of us all that there is no need to refer to it—indeed, even if the need existed, one would justifiably shrink from supplying it. At the same time it will probably be of value to all of us to consider briefly both the evolution of the industry under the stress of war conditions and the rapid revival of its prosperity which we all so confidently anticipate in the near future. The flood of war has inundated the old world we knew so well, submerging and overthrowing the landmarks which were so familiar to us. Now the slowly receding waters are disclosing to view a landscape ravaged, it is true, and swept bare of much that we prized; but we hope that, like the fertilizing inundations of the Nile, this flood will leave behind it a legacy of progress and prosperity.

ADVERSE INFLUENCE OF GOVERNMENT CONTROL.

You are all aware of the invaluable national services given so freely by our industry during the war, and without which this country must have succumbed to its enemies. But it is painful to have to confess that the control imposed by the Government was allowed to exercise an influence adverse to the gas industry in every phase of its activity. Gas undertakings were compelled to pay vastly increased wages and prices for coal, oil, and other materials; while at the same time all the old statutory restrictions in respect of gas prices were retained as long as possible. The price of coke was controlled; all the most profitable outlets for tar were closed, and that valuable commodity reduced to the position of a drug on the market; while the price of sulphate of

ammonia was fixed at a figure which was extremely favourable to agricultural interests. When the Government at length introduced a belated measure of relief, it was of such a nature as to seem to mock those whom it purported to assist; for it tore-up the statutory guarantees on the faith of which investors have for several generations supplied the capital necessary for the carrying on of this great public service, while the already limited dividends were reduced in a most unjustifiable manner.

This was the reward the industry received for its services; but as evil must have its complementary good, so out of the stress and difficulties of these unexampled times arose the unity of all the interests, company and municipal, engaged in the gas industry which are to-day embodied in the National Gas Council, to whose exertions we owe the larger measure of relief known as the Gas Regulation Act, which has recently received the Royal Assent. As a result, too, of the complex and manifold labour problems which had their genesis in the conditions attending the war, it was found necessary to establish a body representative of the industry as a whole, which could enter into collective bargaining with the trade unions concerned; and thus the Federation of Gas Employers came into existence. Both of these bodies have, as is very natural, received their due share of criticism; but I am sure that all those who assisted at the deliberations of the original committees, through which the present organizations were evolved, will bear testimony to the constant and persevering efforts which were made in the face of immense difficulties to avert from the industry the evils which were threatening it. I am certain that all will agree that the gas industry is under a deep and lasting obligation to Mr. Milne Watson for the indefatigable perseverance and patience he exercised in guiding the fortunes of the industry through the period of unexampled difficulty and danger which has passed, let us hope, never to return.

THE GAS REGULATION ACT AND MULTIPLICATION OF RESTRICTIONS.

The outstanding achievement of the National Gas Council is, of course, the new Gas Regulation Act; and although opinions may vary very much as to its value, it is questionable whether, but for the united action of the industry, any general measure of relief would have been introduced into Parliament up to the present date. It is not my intention to review in any detail the principles of the Act as affecting the future technical progress of the industry, as I feel strongly that each undertaking must work out the problem in accordance with its own local conditions; but I certainly think a strong protest should be made, in the interest both of gas undertakings and their customers, against the action of the scientific precisians who are endeavouring to secure the imposition of exacting clauses restricting the percentage of inert constituents and of carbon monoxide, and at the same time imposing a minimum methane content. The carbon monoxide bogey was raised over twenty years ago; and neither then nor since has evidence been adduced which could in any way justify its resuscitation, especially at the present time when water gas has proved such an invaluable auxiliary in promoting coal economy. With regard to inert constituents, it will be apparent to anyone who considers the question impartially that, under the system laid down in the Act of selling gas by thermal units instead of volume, any undertaking supplying an undue percentage of inert constituents will be penalizing itself so heavily that some additional penalty would be entirely superfluous; while the proposed fixing of a minimum percentage of methane is one of those super-refinements which appeal so strongly to certain academic scientists. The chief argument, however, against this multiplication of restrictions is the fact that compliance with these requirements, together with the very complicated and expensive system of testing necessitated thereby, would increase very greatly the cost of producing thermal energy in the gaseous form, and would permanently hamper all progress and initiative.

GAS UNDERTAKINGS AND FUEL CONSERVATION.

There is one very vital matter, however, in connection with future working under the Gas Regulation Act; and this is the question of the output and quality of coal. The invaluable joint report of Sir Dugald Clerk, Prof. Smithells, and Prof. Cobb has shown that in the process of gas manufacture at the present time from 70 to 80 p.ct. of the heating value of the coal is returned to the public in the form of gaseous, liquid, and solid fuel, while the average electricity undertaking at the present time renders available for use less than 8 p.ct. of the heating value of the coal. These facts are so familiar to all of us here that it seems superfluous to refer to them; but, in my opinion, we cannot repeat them too often, in order that the general public may realize the immense possibilities of gas undertakings as agents in the fuel conservation so essential in view of the diminished coal output.

COAL OUTPUT AND QUALITY.

At the present time we know to our cost that the output of coal shows a great falling-off as compared with the period prior to the war; but I would venture to submit that the effect of the reduction in output is even greater than is shown by the official tonnage figures, on account of the vastly increased quantity of ash and foreign matter which is now delivered with the coal. In 1913 the output of the South Wales coalfield was 56,500,000 tons; and this had fallen in 1919 to 47,500,000 tons—a decrease of some 16 p.ct. Extended tests of coals delivered to my own Company, however, show that the amount of matter useless for gas-making contained in the coal has increased enormously in the same period. In many cases the coal delivered was almost worthless for gas manufacture, as the following figures of tests of actual samples will demonstrate:

Class of Coal.	Small.		Through.	Large.	
	A	B	C	D	E
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Moisture . . .	5·66	5·38	3·55	1·01	2·06
Volatile matter .	17·93	21·09	16·66	22·83	15·30
Fixed carbon . .	42·39	41·52	48·55	52·06	51·37
Ash	34·02	32·01	31·24	24·10	31·27
	100·00	100·00	100·00	100·00	100·00

These are typical instances, which could be paralleled in the experience of most gas engineers, of some of the more serious cases of deterioration in quality, and there is no intention to produce them here as representing the average state of affairs. It must be said, however, that deliveries of material of this very low quality are of far too frequent occurrence, and have in many cases rendered it almost impossible to continue the manufacture of gas. I have, however, taken out figures over an extended period, which indicate that the ash content of the deliveries of coal to my Company at the present time shows an average increase of 12·5 p.ct. as compared with pre-war deliveries. If the output figures quoted above be corrected for the increased proportion of ash, it will be found that the actual falling-off in output value is at the rate of no less than 26·5 p.ct. in the case of the particular coals referred to. There is no need whatever to emphasize this very serious state of affairs; but the question of coal output presents a more serious aspect still when one reflects that gas undertakings will be expected to produce gas of good and uniform quality from such material; and the difficulty of the task is greatly augmented by the fact that experience shows that the amount of ash in a particular coal fluctuates at the present time in a most irregular manner from day to day.

It is proposed to review the whole question of the remuneration of colliers having regard to the output of coal per man; but mere increase in tonnage will be of very little benefit to the gas industry unless it is accompanied by a distinct improvement in quality. In the meantime, and until a reasonable standard of coal quality has been recovered, it seems distinctly unfair that onerous restrictions as to quality should be placed on gas undertakings, while no restriction whatever exists in respect of the amount of inert matter which may be delivered to them as coal.

Lastly, but not least, it must be pointed out that the economic and financial consequences of the deterioration in coal are of the most serious kind. The railway rolling stock required to carry it is increased by over 10 p.ct., and the cost of handling and all other charges in a like proportion; while the losses occasioned by the reduced make of gas and residuals, the difficulty of maintaining working heats, and the increased clinker and ash produced, add very greatly to the cost of producing gas and its consequent price to the consumer.

CAPITAL AND LABOUR.

The Federation of Gas Employers has been formed to deal with the multitudinous questions affecting labour on gas-works which have arisen during the past few years; and certainly some body of the kind is an absolute necessity if the principle of collective bargaining is to be adopted and maintained as between gas undertakings and the respective trade unions of which their employees are members. During the past five years labour has secured more solid advantages than during the entire century preceding the war; but if these advantages are to be lasting it is absolutely essential that mutual confidence should be restored between employers and employed with a view to raising the standard of production. The abnormal and unexampled conditions brought about by the war are now rapidly passing away; other countries are recovering their power of competition with us, and it is to be feared that, unless a more friendly feeling is restored, our commercial supremacy will disappear, and with it the prosperity of the workers. There is no doubt whatever that some system of profit-sharing, which would give all employees a keener and more active interest in the prosperity of the industry in which they are engaged, constitutes a most effective method of reconciling interests—which are not really divergent, as is so often represented—but are identical with each other. Unfortunately, however, there is a certain school of thought, possessing very considerable influence within the Labour movement at the present time, which is unceasingly endeavouring to create bitter feelings between employers and employed, and to induce the workman to lower his efficiency with the view of rendering the industry which finds him employment worthless to those by whose enterprise it was first initiated. It is perfectly evident that such tactics as these, so foreign to the spirit of our nation, are not of British origin. As a matter of fact, they are the fruits of what may be termed International Communism, the principles of which, carried into practice, have placed Russia in the deplorable position in which we see her to-day. Some sixty years ago the Emperor Alexander II. emancipated the Russian worker from the serfdom to which he had up to that time been subjected; but practical communism has destroyed in a few months the gains of two generations, and again plunged the Russian worker into abject and hopeless slavery.

It may be hoped with every confidence that the common sense and shrewdness which have always been strong characteristics of the British workman will prevent him becoming the dupe of international intriguers; but the epidemic of unauthorized strikes which is so common a feature of our industrial life at the present time, and which destroys the very basis of collective bargaining and trade union authority, is a most disquieting feature. Injudicious outbreaks of this description have been all too frequent at gas-works in this country during recent years; but in very few cases have they been productive of any benefit to the workmen taking part in them, who would have been far better off in every way if they had been loyal to the leaders who, by long service and regard for their best interests, have proved themselves worthy of their trust.

Another marked characteristic of communism is its violent hostility to Capital, which it regards as an unmixed evil, and unceasingly endeavours to destroy. It is quite true that Capital, like everything else, is liable to abuse, and also that its abuse has been productive of great evil; but it is most illogical to suggest the abolition of any system productive of benefit until we are sure that the abuses to which it is liable are irremediable and that the evil resulting from these abuses outweighs the good brought about by the system in question. There is no great institution or system which is not liable to abuse. Wages themselves are put to unworthy uses by the idle, the improvident, and the vicious. But no sane person would on that account suggest the abolition of wages or the reintroduction of the Truck system, with its vastly greater possibilities of abuse. Capital, wisely used and properly regulated, has been one of the most powerful instruments in promoting the progress and the happiness of humanity, for without it the labours of the scientist, the inventor, and the workman would have been utterly vain. Capital is the result of thrift; and, whether in private hands or in that of the State, it must always in the first instance be created by the industry and self-denial of the ordinary average individual, who will not continue to exercise thrift unless he confidently believes that he will be permitted the reasonable enjoyment of the fruits of his prudence and foresight. If once this confidence is destroyed, real thrift vanishes, and for it is substituted either selfish and secret hoarding, which does not benefit the community, or reckless extravagance, with the miseries which inevitably attend it. In either case Capital—as an indispensable agent in the development and promotion of industry—vanishes, and with it inevitably vanishes also the prosperity of all workers dependent upon industry. Communism therefore appeals to the thriftless as a rapid method of reaping a harvest they have not sown; but its triumph would inevitably mean universal poverty and unspeakable misery.

GAS AS A LABOUR SAVER.

The great war through which we have recently passed has brought about conditions—some merely transitory, some more or less permanent—which will influence our lives for generations to come; and it may be well to consider briefly their influence on the future of gas supply. In addition to its direct help in the provision of munitions of war, the gas industry proved indispensable to the nation in many of the domestic crises experienced during the conflict. One of the earliest of these was the shortage of domestic servants, brought about by the employment of female labour in munition works. But the adoption of gas for cooking, warming rooms, and water heating, enabled many a household to tide over the difficulty, and to appreciate for the first time the invaluable advantages of gas as a fuel, with its steady regular heat capable of perfect control by the mere movement of the tap, its availability at a moment's notice, and the complete absence of dirt or ashes. The latter point is a most important one in view of the immense amount of cleaning entailed by the use of solid fuel, especially with the coal raised at the present time, with its undue percentage of ash. In addition to this, the gas industry has saved the situation on many occasions during the war when the shortage of fuel or strikes in the coalfield threatened to leave the householder without means of cooking his food or warming his house.

All these circumstances have had an educational influence which cannot fail to have a most beneficial effect upon the popularity of gas as a fuel in the near future. These considerations, of course, naturally lead one to the question of the supply of gas to the great housing schemes which are now being initiated all through the country. But as a paper will be read to you at this meeting on this very important subject, I do not propose to do more than refer to an aspect of the question which is most important to the general public. I refer to the economy that may be effected by the installation of gas for all purposes in connection with the new housing schemes. In the case of many housing schemes it is proposed to light the houses electrically and to instal gas for cooking purposes only. This involves the expense of providing two sets of mains, two sets of services, two meters, and two sets of internal fittings for the provision of domestic lighting and cooking which could be carried out much more economically by means of one gas installation.

GAS AND HYGIENE.

It has been claimed in the past that electric lighting possesses certain hygienic advantages, as compared with gas lighting; but it may safely be said that there is no substantial or reliable evidence in favour of such an hypothesis, while in actual practice the heat afforded by a gas-burner is most welcome to the average householder during the greater part of the year, as an auxiliary method of warming an apartment and keeping it dry.

Carrying the subject further, it may be pointed out that the provision of gas-fires and a gas wash-boiler reduces very materially the cost of building a house at the present time; while it may be said generally that if a gas undertaking is given the entire consumption for lighting, fires, cooking, and wash-boiler, or water-heater, it will be in a position to provide such a service on terms which will secure a handsome economy to the housing authority as compared with the provision of the double service of gas and electricity.

In the industrial field, gas rendered indispensable service during the war, especially in connection with the heating of furnaces for tempering, annealing, shell nosing and varnishing, metal melting, and hundreds of other operations great and small. The ease with which these furnaces were controlled, and the reliability and regularity of the heating furnished by them resulted in an increased output of work as compared with older methods, as time was saved, the percentage of failures was enormously reduced, and a required standard could be worked to with certainty, while little or no skilled attention was necessary. These features of gaseous heating appeal very strongly to the modern industrial world; and it may be confidently anticipated that in the near future there will be a great extension in the use of gas for such purposes.

The increased employment of gas for domestic and industrial uses would, however, exercise an immense influence in a direction which should appeal strongly to all classes of the community. At the present time, the use of ordinary coal in fire grates and furnaces loads the atmosphere with solid impurities to an extent hardly realized by the average individual. In the months of April and May, 1914, the "Lancet" Committee of Investigation took steps to ascertain the actual weight in metric tons of the deposit from the atmosphere on each square kilometre in certain districts; and the figures obtained in each case for one month varied from 29·86 tons in Birmingham, 20·64 tons in Liverpool, 17·92 tons in Newcastle, and 17·78 tons on the Thames Embankment, to as low as 1·76 tons at Malvern. A similar investigation carried out at twelve stations in Pittsburg (U.S.A.) revealed an annual fall of deposit at a rate varying from 595 to 1850 tons per square mile per annum. These figures reveal a degree of atmospheric contamination in our industrial centres which is certainly startling; while the corresponding statistics for Malvern indicate the vast degree of improvement which can be brought about if proper measures are adopted.

These vast quantities of suspended matter in the atmosphere exercise a most prejudicial effect on health, especially in view of the fact that they reduce the intensity of sunshine at all times and even obscure it entirely for considerable periods, while the breathing of the contaminated air must be highly injurious to the lungs. In addition to this, however, the deposition of so great a quantity of soot soils and destroys garments and fabrics; while the sulphur acids which it contains destroy even metal and stonework. Such a state of affairs is a standing reproach to a generation which prides itself upon its advanced civilization, and which has recently passed legislation with the view of securing—not one hour's more sunlight—but opportunity to enjoy one hour's more sunlight during a few months each year. The substitution of gaseous fuel for raw coal in our grates and furnaces would obtain for us more sunshine and brighter sunshine not only in summer, but especially during the winter months, when sunlight is most needed. In addition to this, the labour of cleaning and washing would be diminished, and the repainting and repairing of buildings and structures reduced to a minimum. This is a subject which might well engage the very serious attention of the Ministry of Health; and it may be confidently asserted that even a partial reduction of this atmospheric contamination would render our large towns and cities healthier, brighter, and more cheerful than they are to-day.

EDUCATION AND TRAINING.

Before concluding, there is one more question to which I should like to refer; and my reason for doing so is that it necessarily forms the foundation of the future success of our industry. I refer to the question of the education of engineers and managers upon whom will devolve the responsibility of providing the gas supply of the future. We may safely leave to the Institution of Gas Engineers the framing of a suitable scheme of education; and I do not propose to go into the vexed question as to whether theoretical instruction should follow, precede, or accompany gas-works' experience, because in my humble opinion if you secure the right type of man he will be successful under any good system of education. It is absolutely essential, however, if our industry is to progress that we should attract to it the right type of man. The scope of the gas engineer's profession is widening daily, and, consequently, the requisite training necessitates not only a high standard of general education, but also long and arduous training in the principles of both civil and mechanical engineering, chemistry, general commercial routine, and, if possible, physics and electricity.

No general and comprehensive scheme of training appears up to the present to have been finally decided upon; but I believe that the Institution of Gas Engineers are considering the question; and I would respectfully suggest, in the highest interests both of the profession and of the industry, that it is time the whole of this most important question was set on a sound basis.

Much excellent work has been accomplished since the establishment of the Professorship of Coal Gas and Fuel Industries at Leeds University; but it is strongly felt in many quarters that, in the national interest, as well as in our own, similar facilities should be provided at some of the larger centres in various parts of the country, where some comprehensive schemes of education, covering the whole of the requirements of gas engineering students, might be established. These classes could be framed, if necessary, in such a manner as to meet the needs of others interested in the economical and efficient utilization of fuel generally; and such an extension of their activities would prove of the greatest advantage to our students, whose knowledge would thereby be widened, not only to their own profit but to that of their future employers. We are at a period of transition in our industry when the relative values of old and new methods are being estimated and compared. At such a time as this, we need, above all, men of clear, wide outlook, and of independent judgment, who are able to instil the leaven of new ideas, and thus stir up the spirit of thought and experiment among us.

A WORD OF PRAISE TO THE JUNIOR ASSOCIATIONS.

Many new ideas may prove to be absolutely erroneous, but they have the merit of rousing discussion and bringing about that clash of minds which is the prelude to all human progress. In this connection I should like to refer briefly to the excellent work which is being accomplished by the Junior Gas Associations, which are proving themselves such a valuable addition to our technical associations, and which, I venture to say, constitute at present one of the most powerful means of education we possess. Their members are enthusiastic, keen and inquiring; but, above all, they are for the most part as yet unfettered by that sense of responsibility which so often causes their seniors to hesitate before publicly presenting views which may seem unduly novel or revolutionary. The sense of responsibility will come all too soon to the new generation which is now arising. But, in the meantime, they are exercising their intellects in an open breezy atmosphere, and are thus acquiring knowledge and mental alertness which will serve them in good stead in their future careers.

HOPES FOR A WELSH CHAIR OF GAS ENGINEERING AND FUEL.

It is to be trusted that in the near future this Institution will be able to meet the requirements of its junior members in a similar manner; but I am also ambitious enough to hope that the day will come when we shall have our own Chair of Gas Engineering and Fuel at the University of Wales, and one or more scholarships open to the gas industry in connection therewith.

CONCLUSION.

It would be impossible, without making this address of inordinate length, to refer, even briefly, to all the manifold fields which are now opening to the enterprise of the gas industry. But enough has been said, I trust, to make it clear that, great as have been the temporary disabilities imposed by the war, the permanent gains are likely to be far greater. The inherent stability and soundness of the industry are evidenced by its ability to withstand and survive a degree of neglect and unfair treatment which must inevitably have destroyed one less firmly established. All of you have shown undaunted courage and perseverance, even at times when the outlook seemed dark and cheerless; and the same courage and perseverance, now that the clouds have broken, will unfailingly restore our industry to the position it so honourably held for a century prior to the outbreak of the great war.

COAL PROBLEMS OF SOUTH WALES.

Mr. MADDEN, proposing a vote of thanks to the President, said that, even were the address open to criticism, he thought the unanimous opinion would be that it was one of the best the Institution had ever had. He himself was in agreement with every word that Mr. Canning had uttered; and he felt sure this would be the general view of the members. One or two things in particular had so "hit the nail on the head" that he would like in a few words to allude to them. Coal economy was a most important question. They had all got to get down to it; and the problems of South Wales were rather different from those prevailing in other parts of the country. He was glad to see Mr. Canning's reference to a Chair of Fuel at (say) Cardiff University, and he hoped that it would soon come along, because he believed it would be a fine thing for the industry to be able to take their problems there and have them dealt with. The only clear hope of any outlet from their troubles was to put their backs into it and produce. If they could produce sufficiently, the troubles of the present time would, he thought, be materially reduced.

Mr. BOND seconded the vote, remarking that the address would assist them all in meeting the problems with which they were confronted.

The PRESIDENT, in acknowledgment, said he was afraid the address did little more than state a number of problems; but they were problems they must all endeavour at once to tackle. The more they preached the gospel of work and service, the sooner would they be out of their present troubles.

THE SPECIAL PURPOSES SECTION.

The Committee of the Special Purposes Section, in their tenth annual report, said that three meetings had been held during the year, all of which were well attended. The matters discussed included coke stocks and prices, tar sales, and coal. The instructions of the Local Coal and Coke Committee not to ship coke until a month's stock was held, were taken up by a Sub-Committee, and relief was granted. Mr. H. D. Madden had been elected a member of the Committee in place of Mr. H. H. Langford, who had resigned. The accounts showed a balance of £20 in the hands of the Treasurer.

The report was adopted, on the proposition of Mr. HAZELL, seconded by Mr. ROBB.

ALLOWANCES FOR WEAR AND TEAR.

Mr. HAZELL said he would like to take the opportunity of imparting a slice of information which he believed had not as yet reached the industry generally. They would remember that some time ago a Sub-Committee of the Gas Companies' Protection Association were commissioned to consider the aspects of income-tax as affected by depreciation of plant and material. Their labours in approaching the Inland Revenue Authorities resulted in establishing a system of allowances for wear and tear depreciation to the extent of 3 p.ct. on gasholders and 10 p.ct. on meters and stoves. Owing to the war, this Sub-Committee got to work again, with the result that their representations were successful in persuading the Inland Revenue Authorities to allow an increase of 50 p.ct. on the previous allowances—making them 4½ p.ct. upon gasholders, and 15 p.ct. on meters and stoves, in consequence of the very rapid depreciation on account of the war. This arrangement existed for two years, and then it stopped. But the Committee got together again, and represented to the authorities that the war effect was more lasting than was realized would be the case when first consideration was given to the matter. After nearly twelve months of persistent effort and negotiation with the Inland Revenue, they had just heard that the Authorities had granted another year in respect of these allowances. This meant a very appreciable amount to large undertakings. Where any of them had been carrying out this arrangement of claiming for excessive depreciation, they would very shortly get the information he had given them from the local income-tax people.

COUNCIL OF THE INSTITUTION OF GAS ENGINEERS.

Proposed by Mr. ROBB, and seconded by Mr. E. D. WOOTTEN (Abertillery), the President was elected as representative on the Council of the Institution of Gas Engineers for the year commencing in June, 1921.

SUPPLYING GAS TO HARDWICK VILLAGE.

Mr. JAMES ROBB (Chepstow) then read a paper on the cost of mains, services, and piping houses at Hardwick Village. This, with the discussion, will be found on p. 215.

The author was heartily thanked for his paper, on the motion of Mr. EVAN REES (Margam), seconded by Mr. J. P. JONES (Caerphilly).

Proposed by Mr. W. C. JACKSON (Neath), and seconded by Mr. A. J. WARD (Cardiff), the Gas Company were heartily thanked for the use of their offices and for their hospitality.

The place of next meeting was left to the Council to determine.

LUNCHEON.

An adjournment was then made to the Westgate Hotel, where the members were the guests at luncheon of the Chairman and Directors of the Newport Gas Company. In the regretted absence through indisposition of the Chairman of the Company (Mr. George Geen), this portion of the proceedings was presided over by Lieut.-Col. A. H. LAYBOURNE.

After the "Loyal Toast," Sir Garrod Thomas proposed "The Wales and Monmouthshire Gas Institution," and pointed out how much the country owed to those connected with the gas industry for providing the high explosive material without which the war could not have been won. The President, in reply, said that at this time of day no one could doubt the necessity for the District Gas Associations. Their own Institution began in a small way in 1905; but now it represented an annual make of gas of 5600 million c.ft., or about 90 p.ct. of the output of the entire district. There were some 70 to 80 gas-works represented among them. Alderman Morgan submitted the "Chairman and Board of Directors of the Newport Gas Company;" and this was acknowledged by the Chairman, who said he had not the slightest doubt the industry would weather the storm, and advised the members to "keep their tails up."

THE CRINDAU GAS-WORKS.

A special car was waiting; and in this the visitors were conveyed to the Crindau manufacturing station of the Company over which they were shown by the President and his assistants, who had many interesting features to explain.

The Crindau works were designed and constructed under the supervision of the late Mr. Thomas Canning, and were opened in 1885. The retort-houses contain eighteen benches, each of nine 18 ft. retorts, operated by Fiddes-Aldridge stoking machines, with continuous hoppers, and fitted with Aldridge-Gibson patent doors. The siding from the Great Western Railway stands about 25 ft., above the general yard level, which enables the coal to be tipped direct from the trucks into the breaker, the hopper, or any portion of the store. The tipping of the coal is effected by a travelling electric crane, while electric capstans of modern type enable the traffic on the sidings to be handled rapidly and efficiently.

The coke handling is carried out by means of a telpher which is capable of delivering the coke either upon the yard itself or

straight into wagon on the sidings. The supports of the present telpher-track present some features of interest, as they were constructed at a time of great emergency during the war, from materials which the Company happened to have in stock at the moment. In January, 1918, as the result of war conditions, a large stock of coke, amounting to some 4000 tons, had accumulated at the works; and this was stacked, by means of the telpher, to a depth of some 20 ft. to 25 ft., around the existing telpher standards, which were of steel.

A fire was discovered in the coke heap on Jan. 15 of that year, which, in spite of immense efforts by the Newport fire brigade and the depleted staff of the Company, burned for three months before it was finally extinguished, and destroyed the greater portion of the telpher-track. Had sufficient labour been available, it would probably have been possible to deal with the fire and save a considerable portion of the telpher; but the securing of a sufficient number of workmen at that critical period of the war was absolutely out of the question. However, by great efforts, the junctions of the telpher-track at either end were saved; and the continuous manufacture of gas was thus safeguarded. As soon as circumstances permitted, the work of reconstruction was put in hand; and in view of the difficulties of getting material, the new supports were constructed of Mannesmann tubing, which the Company had in stock, filled with cement grouting, and surrounded with cement concrete with an aggregate of old well-burnt crushed fire-brick with "plums" of the larger material. The work was commenced at the end of April, 1918; and the track was restored in time for the following winter season.

Adjoining the retort-houses are the condensers, the scrubbers, washers, and large tar and liquor tanks; and at the present time an old and inadequate set of condensers is being removed to make way for a new water-cooled condenser. The boiler-house, exhauster-house, and pump-house follow in turn. Across the road from these is situated a new block of buildings containing fitting shop, smiths' shop, carpenters' shop, and workmen's mess-rooms; while close by is the electric power station. The whole of the electrical energy required is provided by means of gas-engines, which form a most convenient and efficient method of producing it. There are two purifier-houses, containing purifiers in groups of six; while a new large set of six purifiers, each 30 ft. square, with Sadler-Cockey patent centre-valve, has just been completed on the opposite side of the road.

On the same side is the water-gas plant, which is now being reconstructed to double its former capacity. In connection with these extensions, a new rotary meter of 80,000 c.ft. per hour has been installed, and a boiler-house erected, containing two 30 ft. by 8 ft. Lancashire boilers; while the air-blast is furnished by a turbo-driven fan—an electric fan being provided as a stand-by. Near the works entrance are situated the meter and governor house, with the offices and laboratory. Adjoining the meter and governor house is the booster-house, in which are installed two booster fans, one capable of delivering 150,000 c.ft. per hour with a pressure increment of 12 in., while the other has a capacity of 300,000 c.ft. per hour, the pressure increment being 20 in.

A return to the Westgate Hotel for tea brought to a close a meeting which had been in every way successful.

COST OF MAINS, SERVICES, AND PIPING HOUSES AT HARDWICK VILLAGE, CHEPSTOW.

By JAMES ROBB, of Chepstow.

[A Paper read before the Wales and Monmouthshire District Institution, Oct. 21.]

In preparing this paper for your consideration, I thought it would not only be useful to our own Institution, but also to the whole gas industry, in the way of giving something definite and reliable relating to costs, in the way of mains, services, and internal piping of so-called "Garden Cities"—in our district designated villages.

Hardwick Village is unique, in that it is the only one in this country that was being built during the war, and was constructed under the most trying and adverse conditions that ever existed, or are likely to be encountered again in our time. The scarcity of labour was such that women had to be employed in trench excavating; and we ourselves had to engage women assistant main and service layers, as we had only one trained fitter on the works, who had also to attend to other work in the town as occasion required. Owing to the want of housing accommodation, special trains were run morning and night to and from various neighbouring towns. All sorts and conditions of labour were employed, and as to procuring the necessary materials, I am unable to tell you now how I obtained them, beyond that I did get them. But I pray I may be saved from a repetition of this experience.

But now to the important part of this paper. I will begin by quoting the prices of the various materials used in our department of the construction.

Cast-Iron Mains.—3 in. to 6 in., un-coated, S. and S. joints, f.o.r. Chepstow, cost in 1914 £4 17s. 6d. per ton; 1916, £7 15s.; April, 1917, £8 12s. 6d.; September, 1917, £9 10s.; December, 1917, £10 12s. 6d.; December, 1918, £14 12s.; October, 1919, £17 14s. 6d.; May, 1920, £21 2s. 6d.; July, 1920, £21 5s.

Wrought-Iron Tubes.—1914 discount, 72½ p.ct.; 1916, 50 p.ct.; June, 1917, 48¾ p.ct.; December, 1917, 46¼ p.ct.; December, 1918, 37½ p.ct.; February, 1919, 30 p.ct.; May, 1919, 26¼ p.ct.; December, 1919, 21¼ p.ct.; January, 1920, 15 p.ct.; April, 1920, 12½ p.ct.; May, 1920, 2½ p.ct.; Aug. 31, 1920, list *plus* 5 p.ct.

Compo.—1914, 29s. per cwt.; 1916, 43s. 6d.; 1919, 46s. 6d.; and 1920, 69s.

Old lead we were buying locally in 1914 at 10s. per cwt.; 1916, 34s. per cwt.; 1918, 30s.; and at present, 30s.

Previous to 1914, I was laying new "S. & S." mains in ordinary macadam roads at 1s. per inch diameter per yard, 3 ft. deep covering, including all charges, which rule I found held good for 4 in. to 7 in. for a number of years. In 1916, I laid 500 yards of 4 in. "S. & S." mains, and found the cost had advanced as follows: Cast-iron mains, including specials, 3s. 10d. per yard, opening and closing trench and after-repairs 2s., lead, yarn, and paint 4d., main laying and fuel 6d.—total, 6s. 8d. per yard.

In preparing the estimate for canaling the new village, I took the above as my basis, *plus* 25 p.ct. increase. But I think it is needless to tell you that my estimate is only a shadow of the actual cost. However, after my Directors had considered the cost and the probable return therefrom, it was resolved to proceed with the work. Following the then prevailing practice, I decided to pipe the houses all over at £1 1s. 6d. each, exclusive of burners, pendants, and other gas-consuming appliances—laying services free up to the meters, but the contractors finding and erecting the meter-shelf. We started on the work of main-laying in January, 1917; and piped the houses when ready for us.

As soon as the first houses were tenanted, the occupants began to inquire as to the setting of gas-fires, geysers, and gas-heated washing coppers. When the matter was placed before the architect, we were instructed to arrange for points for gas-fires in every room except the kitchen. My Company agreed to do so at £2 per house all over; but in March, 1919, prices bounded up so rapidly that we were compelled to advance our prices to £6 10s. per house, and in February, 1920, to £9 per house.

Now, as to the cost of internal piping. We run ¾ in. barrel from the meter to the cooker and up to, and under, the bedroom floor into the centre of the building, with ½ in. branches when supplying more than one burner, and the drop pipes, when short, ¼ in. barrel. When we began piping for gas-fires, ¾ in. barrel was used past all burners, and thereafter ½ in. barrel to fires—the connection for these being placed clear of the hearth stone, so as to allow of easy access thereto at any time. The first houses, with eight points for lights and one for cooker, cost us £4 17s. 9d., or 10s. 10d. per point, in July, 1917, exclusive of the cutting of stone or woodwork.

In August, 1919, with thirteen points—viz., eight for lighting, four for fires, and one for the cooker—the cost was £8 11s. The details are: Material per point, 8s. 7½d.; labour, 4s. 6½d., equal to 13s. 2d. per point. Material per foot, 1s.; labour, 6½d.; equal to 1s. 6½d. Of piping 113 ft. was used, equal to 9 ft. per point. Time per foot half an hour, or 4½ hours per point; bends, &c., 2d. per foot run, or 1s. 3½d. per point.

By Nov. 12, 1919, the costs rose to 15s. per point—seventeen points—ten lights, six fires, and one cooker. Material per point, 7s. 2d.; labour, 7s. 10d.—equal to 15s. Material per foot, 10½d.; labour, 11½d.—equal to 1s. 10d., 138 ft. of piping, equal to 9 ft. per point. Time per foot, half an hour, or 4½ hours per point; bends, &c., 5d. per foot run, and 3s. 5½d. per point. The total cost was £12 14s. 2d.

In May, 1920, the costs were 18s. 3½d. per point—viz., material per point, 7s. 0½d.; labour, 11s. 3d., equal to 18s. 3½d. per point. Material per foot, 9½d.; labour, 1s. 3½d., equal to 2s. 1d.; 105 ft. piping, or 8 ft. 9 in. per point. Time per foot, three quarters of an hour, or 6 hours per point; bends, &c., 4½d. per foot, or 3s. 4d. per point. Total cost, £10 19s. 4d. for twelve points per house—viz., eight lights, three fires, and one cooker.

The details of materials and time for this twelve-point house are as follows: 34 ft. ¾ in. pipe, 30 ft. ½ in., 32 ft. ⅜ in., and 9 ft. ¼ in., all barrel piping, one ¾ in. connector, five ¾ in. elbows, seven ¾ in. tees, one ¾ in. bend, two ¾ in. reducers, one ½ in. bend, one ½ in. reducer, two ½ in. elbows, four ½ in. barrel nipples, two ½ in. tees, three ½ in. plugs, one ⅜ in. tee, ten ⅜ in. elbows, three ¼ in. sockets, two ¼ in. elbows. Fitter, 36 hours; labourer, 36 hours.

It will be observed from the foregoing that prices do not coincide to a very small fraction in the detailing, but are as near as perfection as practicable. There are also variations in the cost of piping and labour caused by the construction and formation of the various houses.

The subsoil is mostly rock—an agglomerate of slate and limestone especially on the north side; while the remainder, or about one-seventh, is composed of red clay. The mains and services were laid when the roads were being made, and have not less than 3 ft. of covering, except the service-pipes in the gardens, which vary in depth according to circumstances.

There are 360 yds. of 6 in. diameter mains, 1300 yds. of 4 in. diameter, and 1467 yds. of 3 in. diameter, all with S. & S. joints. The total, including bends, tees, &c., amount to 3200 yds., and the cost per yard run for all the size of mains works out as follows:

	Per Yard.		Total.
Mains	£0 7 1¾	..	£1135 7 7
Lead, yarn, and fuel	0 0 9	..	127 4 5
Wages, opening and closing trenches	0 5 7	..	894 6 8
Fitters and assistants	0 3 0	..	488 0 0
	£0 16 5	Gross	£2636 18 8

There are 3100 yds. of 1¼-in. and 1-in. wrought-iron piping; and the cost works out as follows:

	Per Yard.		Total.
1¼ in. and 1 in. wrought-iron tubes, including bends, &c.	£0 3 6	..	£542 10 7
Opening and closing trenches (mostly rock)	0 7 9½	..	1200 4 10
Fitters and assistants	0 3 11	..	600 0 9
	£0 15 2½	Gross	£2342 16 2

The services are interlinked so as to make the pressure as far as possible equal over the entire village, which we fitted up, including setting meters; the contractors providing and fixing meter-shelves free. The cost per service comes out at £10 2s. each, with a gross cost of £2200 3s. 1d. for 200 houses.

The total cost amounted to £7179 17s. 11d. for mains and services, exclusive of internal piping, or £36 per house, and with loss on internal piping (£4 per house) equals £40 per house. So that, to make it a paying concern, each house will require to give a clear profit of £6 per annum.

In conclusion, I should like to add that there is only one syphon or trap serving the entire village; and there are still another hundred houses to be erected to complete the scheme. When our new works are in operation, all the ends of the 3 in. and 6 in. mains will be connected into a large main coming therefrom.

The village streets are lighted by 30 lamps, and one existing previously makes 31. The columns are 11 ft. 6 in. high; the lanterns being Willey's "Commercial," No. 1932. Instead of a single mantle, however, I have substituted a tripod burner of three bijou mantles, self-intensifying, which give a luminosity of 165 candles, with the light very evenly distributed. I may add that Willey & Co. have adapted the principle to domestic burners, and named it the "Chepstow" burner.

The mains were laid in sections, and the services attached at the same time. Before being connected to the live sections, they were tested by air pressure at 24 in. All proved tight, except in one instance, where, in laying a drain, the workmen broke a service pipe and covered it up without reporting the matter.

DISCUSSION.

The President (Mr. J. H. Canning) remarked that the paper was a useful one, and full of practical information. The author did not say whether the tenants of the houses were prepayment consumers or taking gas through ordinary meters.

Mr. Robb: All prepayment meters.

The President went on to say that Mr. Robb had been a pioneer in this work. It was easy to follow, when the way was pointed out; but the author had to work out all the problems for himself, at a very difficult time, when the securing of materials and labour was almost impossible. The figures showed the enormous increase that had taken place in prices, more particularly during the latter portion of the period referred to. In the matter of the internal piping of the houses, he was glad to see the wise course had been followed of putting-in pipes of ample size everywhere. This was one of the most important points to be considered at the present time, if they were going to fully develop the use of gas. They were all aware how much in the past the extension of gas in dwelling-houses had been hindered by the ridiculously small pipes that had been put in them. These had often rendered it totally impossible to give satisfaction with water-heaters, fires, and sometimes even cookers. Mr. Robb would have ample reward in the future for his enterprise in this respect. The numbers of points varied a little; and he took it that the houses were of different sizes. In the case of the houses completed by Nov. 12, 1919, the time occupied was 4½ hours per point; whereas in May, 1920, the time was 6 hours per point, apparently for the same number of points. He wondered whether this was due to a deterioration in the efficiency of labour, or to some other cause. The 3200 yards of cast-iron main did not much exceed the cost of the 3100 yards of wrought-iron piping. The labour charges on the wrought-iron piping were heavier. Mr. Robb was to be congratulated upon having established at Chepstow the principle of the "all-gas" housing scheme, which was certainly the most economical method of lighting and heating. In addition to this, he had secured the street lighting. Had any attempt been made to carry out this work by means of a duplicate service of gas and electricity, the result must have been to add largely to the cost of the whole scheme.

Mr. W. C. Jackson (Neath) said that, as one who was following in the footsteps of Mr. Robb, and carrying out at the present time a very large amount of main-laying for the supplying of gas to what would be a Garden City, the paper had been of very great service to him. Like Mr. Robb, he was quite a believer in large pipes for internal fitting, and also in making provision right away with the architects for an all-gas house. At Neath, they were successful in getting contracts fixed up nearly two years ago for a housing scheme connected with oil-works; and the first instalment of houses was nearly ready. They were all-gas houses, and were being fitted-up for gas lighting, cooking, water-heating, and gas-fires in bedrooms and living-room. The prices Mr. Robb gave for main-laying had struck him very much, because they coincided to a great extent with those for which he had contracts at the present time. In the paper, the cost of cast-iron mains and laying was given as 16s. 5d. per yard run. When they threw their minds back to pre-war days, this looked absolutely abnormal; but this was an average for 3 in., 4 in., and 6 in. The figures under his own contracts worked out as follows with steel mains, Stewarts and Lloyds' long-sleeved joints, and lead, cost for main and laying: 3 in., 10s. per yard; 4 in., 12s.; 6 in., 18s. 9d.; 8 in., 26s. 3d.; 10 in., 38s. 9d.; 12 in., 41s. 9d. This, of course, included material and labour. Steel piping would probably cost more now. In his case, they took immediate delivery; and the pipe was received at the works something like four months ago. Since that time, prices had gone up. It made a manager think very seriously as to main-laying, when he was faced with such heavy costs as these; and it was only when they could be assured of an adequate return from the consumption of gas in these houses that they would be justified in recommending that the mains should be laid. Thus there was all the more necessity for every one of them to boost the all-gas house, so as to encourage an adequate consumption. He was laying the mains and services; but everything else, except the meter, was being paid for by the oil-works people.

Mr. J. E. Kenshole (Merthyr) said the paper would be of value to him because at the present moment he had before him a request to lay mains to a considerable number of houses for the Corporation scheme. Mr. Robb said the mains and services cost £36 per house. This was a very serious item; and he would like to know what average consumption per house the author obtained. Having slot-meters, he took it a charge was made of 10d. or 1s. above the rate to ordinary consumers. What sized meters did he put in? The whole point, to his own mind, was whether it was a paying proposition. It was all very well to boost all-gas houses; but an undertaking could easily be put to very great expense, and it was of no use to incur outlay unless there was a reasonable return for it. Application was made to his Company to lay mains to a number of houses, and a few of them were up and piped more particularly for lighting. But they started going into the cost, and he asked what proportion the Corporation were going to pay, because it was quite plain to him that they would never get an adequate return on the cost of laying mains and services alone. When this came before the Corporation, they immediately wrote to the Electricity Company, and wanted to know whether they would lay cables to these houses. He decided that, if he got the work, it was going to be a commercial proposition—nothing more nor less. To lay mains and services the length required to supply these houses, and taking the average consumption by similar consumers, it would not be a paying proposition if they were only going to get 6d. or 8d. per 1000 c.ft. more than from ordinary consumers, unless the authorities came to the rescue and said they would bear a fair proportion of the cost.

Mr. A. J. Bond (Aberavon) also had a housing scheme which had just been started. He would like to ask whether gas-fires, when provided, were used; and could the author give the annual or quarterly consumption per customer? In his own case, they were installing gas-fires throughout the houses, upstairs and down, which meant that three or four bedrooms and a parlour would have gas-fires. Only one coal-fire was provided for. The usual cooker was included, and a wash-copper. Some members of his Council were rather doubtful as to whether or not the fires should be put in; but he was pleased to say they had adopted his recommendation to do so.

Mr. H. D. Madden (Cardiff) said the paper showed clearly how enormously costs had gone up. He personally had always held that proper attention to carcassing was vital to the interests of the gas suppliers. A large proportion of their troubles in the past was due to small compo. pipes hanging like festoons under the floorboards, and other matters of this kind. Iron barrel was the finest system of carcassing; and he was glad to see that ample size was allowed in every case. In regard to the desire of working men to have gas, he remembered a case a good many years ago in the East End of London, where a local council built a street of very nice houses, but would not allow gas to be used in any shape or form—all being wired for electricity. Only about 25 p.ct. being inhabited, inquiry was made, and the answer given was that people wanted a cooking-stove, &c. Eventually the gas company were permitted to put down a main, and there was a rush for the houses. This happened before the war. In discussing some of these points, they must not lose sight of the fact that, though there was the first cost to face, they should be prepared to back their opinion that to-day was the gas age, and that everyone would benefit by using clean fuel brought to his house in the manner Mr. Robb had indicated in the paper just read.

Mr. Evan Rees (Margam) said he was well able to appreciate some of the author's difficulties, because at the present moment he had a scheme on hand for a Garden City, and he knew how hard it was at the outset to convince London architects especially as to the advantages of gas over electricity. He had had much trouble to get them to agree that the one service was sufficient for domestic needs; but it had proved to be so in the houses already erected and occupied. The scheme his Council were interested in was not their own, but belonged to Messrs. Baldwin's, Ltd.; and at present they were fitting-up some 200 of the houses. The equipment of each house consisted of seven lighting points, a gas-cooker, and a wash-boiler; and in certain types of houses one gas-fire was included. Mr. Robb had given them no particulars of the gas-cooker used; and he would like to hear something as to this. In his own case, he found that the cooker played a very important part in gas equipment; and it was from it that the gas supplier was going to receive a good deal of his revenue. The gas-cooker he employed was of the single-case type, with packed door; but there was a four-burner hot plate. After making considerable investigation with regard to cookers, he came to the conclusion that the hot-plate got far more use than the oven. The consumer preferred ample hot-plate facility to having a large oven. Bearing this in mind, he selected a cooker of the type indicated; and so far it had given every satisfaction. The question of gas consumption had been raised; and if it would be at all helpful, he would give his own experience, though the houses had not been occupied anything like twelve months yet, but only about four months. They were, however, all prepayment meters, and quite a number had been collected from. The consumption, so far as he was able to judge at the moment, would work out at something between 20,000 and 30,000 c.ft. per annum. He was absolutely certain it would be not less than 20,000 c.ft.; and a fair average figure might be taken as 25,000 c ft., which was an increase of 9000 c.ft. over the present average. So that, although a large amount of capital must necessarily be expended to meet the needs of these housing schemes, personally he had not much fear of them turning out not to be business propositions. As to prices, Mr. Robb's schedule was certainly very illuminating; and it demonstrated one of the difficulties that faced all undertakings in respect of development work.

Mr. Robb, in reply, explained that most of the houses were terraced-up, and some of them built back. This was why they had had to run very long lengths of pipes, which had caused the services to cost so much. He supposed the figures Mr. Jackson had quoted for mains and main-laying referred to work in ordinary soil and on flat

ground. At Chepstow the ground they had to deal with was mostly very hard, rocky stuff; and this was one of the reasons for any difference in cost. He had been asked as to the average gas consumption. Well, the people at his village in Chepstow spent money very freely. Where cookers had been introduced, he found that the average consumption—and this held good for the summer as well as for the winter quarters—came out at 15,000 c.ft. per quarter. They put in meters of different sizes—some 3-light, and others 10-light. The same price was charged as to ordinary consumers—5s. per 1000 c.ft. At present they could not go higher than this. At the time the work was undertaken, the shipyard belonged to the Standard Company, and they promised to assist—the cost of main-laying; but when the Government came in and took the thing up, they threw this arrangement aside. Had the Government been in control at the time the work was started, this assistance would have been insisted upon. There was a village near-by where electric light had been forced upon the people; but the tenants had held meetings to protest against it, and had appointed a committee to try to secure a gas supply. Since then his Company had been approached on the matter; but up to the present they had not seen their way clear to comply. With regard to the question as to gas-fires being used, in his case the consumption had grown so rapidly, and the demands on their producing capacity had become so great, that they had not yet seen their way to particularly encourage the use of gas-fires. By next spring, however, they hoped to be in a position to supply all possible demands. It was easy to get at the internal pipes, as the floorboards over them were all fastened down with screws. The cooker they recommended was the biggest size of the Cannon "Homely." He agreed that with the cooker the hot-plate was really the most important part. If the money required to supply these housing schemes with gas had to be extended for lighting alone, the game would not be worth the candle.

COAL AS A FUTURE SOURCE OF OIL FUEL SUPPLY.

Abstract of a Paper read by Sir Arthur Duckham, K.C.B., M.Inst.C.E., on Oct. 19, before the Institution of Petroleum Technologists.

[Publication of this paper *in extenso* is reserved by the Institution.]

In his opening remarks, Sir Arthur Duckham said he had concluded that it was almost impossible to make any definite statement as to the best method of treating coal to obtain the best value in oils and tars; and therefore he proposed to outline the present situation and then make some suggestions as to future development.

Sources of Energy.

Mineral oil, discovered in the United States, was used first as a source of heat and as a lighting medium; but it was only tardily realized that its products could be used as direct power in the internal combustion engine, which revolutionized domestic and industrial life and made oil supplies not only desirable, but indispensable. To-day there was a world shortage of fuel. The war had closed-down many sources of supply; working hours and the value of the man-hour had fallen. But the demand for energy derived from fuel was ever-increasing.

In future, economy would preclude the costly transport and man-handling of solid fuel and its solid products; and we should use liquid fuel for locomotion and power on sea and land. At present, however, shortage and high costs made liquid fuel impossible as the general means of supplying heat and power; and yet, the necessity for coal conservation demanded efficiency in its consumption. Electricity, with its 80 p.ct. heat-unit loss, was unthinkable as the medium of supply.

There remained one other method of transmission of heat units from the coal—the source of our fuel supply—to the industrial or domestic consumer, and that was gas; and he believed the industrial future of the country lay in converting coal at the pit's mouth into liquid and gaseous fuels. Liquid fuel would provide energy for all transport, with the exception of electricity for congested areas; while gaseous fuel would be used direct for the majority of heating purposes and the generation of electricity.

Sir Arthur then proceeded to outline the different processes for the heat treatment of coal.

Gas-Works.

The prime object of high-temperature carbonization, as carried out in most gas-works, was the manufacture of coal gas for lighting, heating, and cooking. Antiquated legislation and financial restrictions had long prevented the wide development of gas manufacture; but these had now been removed, and the future held much promise for the industry. From his remarks, it was clear there was not much hope of supplementing fuel oils from horizontal retorts, but he spoke more hopefully, though acknowledging limitation, of continuous vertical retorts. With these great strides had already been made, notably in the generation of water gas through the utilization of steam in conjunction with the charges. By this means the output of gas was enormously increased, and the hydrocarbons generated from the coal were protected; thus further increasing the make of the lighter tar oils. The steaming process might be developed by superheating the steam, and the employment of waste heat for generating the steam; but there was an economical limit reached before total gasification had been achieved.

This was undoubtedly the line of advance in gas-works practice; but from a national viewpoint the conveyance of coal and coke to and from the works was objectionable. The coal pit was the right place to make gas.

Coke-Ovens.

With regard to the fuel oil possibilities of the coking industry, he said about 50 p.ct. of the gas made in bye-product coke-ovens was available for distribution. The tar oils were similar to those made in gas-works, while further light oil might be procured by stripping the gas of saturated hydrocarbons. The hard coke, however, was not a commercial product except for blast-furnace and foundry purposes; and many improvements were necessary—mainly in ensuring an even quality of gas for distribution—to make the prospect of development attractive. He believed that gas, not coke, would in future be used to smelt iron ore, in which event the coke-oven would be eliminated.

Low-Temperature Carbonization.

After touching briefly on producer gas of low thermal value and the resultant poor tar oils, Sir Arthur considered the difficulties attending low-temperature carbonization, particularly with coking coal and its residue. Were the difficulties overcome, the process would be most valuable in producing tar oils high in quantity and quality, light oils from the gas, and satisfactory briquettes from the residue. But still there remained the inherent disabilities of the solid fuel.

Complete Gasification.

The principle of this process was the partial carbonization of coal in a vertical retort superimposed on a water-gas generator; the plants being built in duplicate, and the gaseous products passed up one and down the other, in order to fix the hydrocarbons and retain them as gas. In spite of mechanical disadvantages, general economy was obtainable; but no tar oil was obtained and ammonia was lost. He recommended such a plant to the small gas-works, or as a "regulator" in a large works.

The Ideal System.

Having thus very briefly reviewed the various processes for the heat treatment of coal, Sir Arthur formulated a system of manufacture to meet the demand for liquid and gaseous fuels for practically all purposes. The total gasification of coal was essential, preferably in one vessel. The plant must be economical in first cost, and low in labour charges. But above all the maximum amount of the volatiles in the coal must be recovered in a liquid form, being distilled over at such temperatures and in such a manner that a minimum of cracking takes place. The gas afterwards should be stripped of all saturated hydrocarbons and supplied to the consumer constant in both heat value and specific gravity.

Further, special care must be taken to preserve the ammonia. The plant must be designed to work with any coal; but he did not believe it possible to design a plant of this type capable of working greatly varying coal over short periods, or of working coal containing over 60 to 70 p.ct. of fines.

The form of plant he suggested was one or more vertical retorts superimposed over a water-gas producer, the retorts being so constructed and heated that even difficult coals (like Durham) would work through without undue attention, and the coal be fully converted into coke before entering the producer. The producer should be built and worked so as to obviate the formation of hard clinker, with mechanical grates for the continuous and clean removal of the ash. Automatic compensating devices would have to be included for the regulation of the pressure in the retorts during the run and blow periods. Such a plant, fitted with recuperators and waste-heat boilers, would have a very efficient heat cycle, which would undoubtedly result in a large conservation of fuel. If the major portion of the coal used in the country were first treated by such a process, the fuel-oil position would be made much easier, as greatly increased supplies would be forthcoming, the demand would accordingly greatly increase, and gas could be distributed to consumers at from one-and-a-half times to twice the amount it would cost per heat unit to supply as solid fuel. The saving in labour and transport, the cleanliness, and the efficiency of utilization would far more than compensate for this increased charge.

Removing Hydrocarbons from Petroleum.—Bulletin No. 162 of the United States Bureau of Mines has for its author Mr. J. M. Wadsworth; the subject dealt with being the removal of the lighter hydrocarbons from petroleum by continuous distillation. This bulletin—in reality it is a volume of nearly two hundred pages—affords a good example of the thoroughness with which the Department of the Interior carry out their work. There are about one hundred illustrations and plates (some twenty of the latter being folded-in). In carrying out one of their main functions—which is to disseminate information regarding investigations made—the Bureau of Mines prints a limited free edition of each of their publications; while subsequent copies are supplied at cost price. The purpose of the particular bulletin now under notice is to describe the methods of constructing and operating representative types of plants in the United States used for the purpose named; and the descriptions are so arranged as to facilitate comparison and to emphasize the important features in each case.

MOTOR FUEL SUPPLIES AND PRICES.

At the Imperial Motor Transport Conference, Olympia, on Monday of last week, Mr. E. S. SHRAPNELL-SMITH (the Chairman of the Empire Motor Fuels Committee of the Imperial Motor Transport Council), in the course of a summary of the present position of motor fuel, referred to the production of benzole in coal-gas manufacture, and also dealt with low-temperature carbonization. He warned the public not to expect large yields of fresh classes of motor fuels at greatly reduced prices in the immediate or near future. War and the after-effects of war had necessarily deferred the realization of any such expectations. New fuels in any considerable volume as compared with total consumption remained unavailable. The single possible exception under the head of supply was benzole, a potential extra volume of which was available in this country (from the stripping of coal gas) to the extent of not less than 30 million gallons per annum, if Parliament chose to impose on the gas consumer a small sacrifice for the benefit of the motor user. The day might come when the Legislature would decide that this transference of right of claim upon benzole from the gas supply of the country was a national necessity for the benefit of road transport. Public opinion was not behind the proposal; while commercial and technical considerations were at present against it. The new gas standard left the gas undertakings free to strip; and the high price of benzole might encourage a resumption of war practice.

Dealing with coal, he said that any considerable yield of liquid motor fuel from coal depended, apart from benzole *viâ* coal gas or new increments *viâ* coke-oven plants, upon the proving and progress of lower-temperature systems of carbonization. The retorting of coal as a definite process at temperatures round 436° C. was prominently brought to public notice by the late Mr. Thomas Parker, of Wolverhampton, in the year 1900. After an initial experimental period, the original "Coalite" developments unhappily came to naught, owing to a combination of circumstances it was unnecessary for him to specify. But from that blow the cause of lower-temperature carbonization had as yet to recover. Failure in the past had inculcated the useful lesson that the disposal of the solid residue was one of the conditions precedent to success.

There was, even more fundamental in character than the disposal of the solid residue, the vexed question of ascertained process costs determined over a period. Again, the disposal of the gaseous and other products, inclusive of ammonium sulphate, presented commercial and physical difficulties, which forbade any sudden leap from present practice in high-temperature carbonization to (say) the treatment of as much as 30 p.ct. of the coal output of the United Kingdom by lower-temperature carbonization. The immediate position hinged upon the proving of designs for lower-temperature retorts, now under test, so that they might be worked day in and day out on true commercial lines.

It was a pleasure to him to bear testimony to the tenacity of the supporters of the claims of lower-temperature carbonization, and to the spirit of caution which pervaded the speeches and literature concerning it for which the Director of Fuel Research was responsible. But conditions were such to-day, as regarded motor fuels, that they could not be governed by old considerations only—new factors were constantly arising, and they must be taken into account. Hence, as one expected, the recent report of the Fuel Research Board expressly referred to the need for revision of former economics in the light of the new factors and new conditions of to-day. The chief of these was the high level of prices commanded by all fuels—gaseous, liquid, and solid. The so-called bye-products were also at high prices in all markets. It was true, of course, that costs of production had not been stationary; but the ruling conditions as a whole favoured the producers, and the inevitable sequel would be an accession of numbers to their ranks. His own guiding aim was to bring about such new producers.

There was but one effective remedy, if coal was to bear its share and in due course take its merited place in redressing the motor fuel shortage. Technical expert opinion must persuade their legislators to discourage (or even forbid) the use of raw coal for domestic and industrial purposes, and, once it was established that such an alteration would be on a sound commercial basis, a beginning could not long be deferred. Coal which had been partially coked must be progressively used instead of raw coal. A new and irresistible force was behind the demand for smokeless cities and towns; the original labours of the Coal Smoke Abatement Society would not have been wasted.

The new residual fuel for consumption in the ordinary open grate of private houses would be such as not to involve any changes of household practice. It was important to refute the idle and ignorant suggestion that there would then be no open fires. Unless all the new residual fuels were virtually interchangeable with coal, the rate of conversion of the public would be slow; but improvements in methods of retorting, discharging, and quenching promised to ensure the attainment of this vital desideratum as a universal quality in such fuels.

DISCUSSION.

Lieut.-Col. CLARKE said that prior to the war he was Managing Director of Coalite, Ltd., and he had in that capacity the opportunity of studying the question of improving the supplies of motor spirit, inasmuch as he had to pay interest on very large debenture issues, in connection with the commercial side of low-temperature carbonization. It had often been pointed out that the carbonization of coal at low temperature had up to the present not been successful commercially; and it was the fact that this source of production of oil fuel had not reached the stage of being self-supporting. At any rate, the margin of profit on it had proved very small. On looking into the position in the Coalite days, a series of experiments were carried out at Barking with cannel coal on a commercial scale to the extent of carbonizing from 10 to 20 tons of cannel per day, and then marketing the products to determine their value. The production of oil per ton of coal was about 50 gallons, from 7 to 8 gallons of which was motor spirit. There were very large quantities of cannel in Great Britain, and these had the additional advantage of being capable of carbonization in any of the present-day well-known and approved types of retorts.

Dr. W. R. ORMANDY, speaking of the possibility of extracting benzole from coal gas, said that those who were most emphatic that this should be compulsory were generally those who did not know the details of the gas industry. The modern tendency in gas-works practice was to produce more and more gas per ton of coal; and if the benzole was extracted from the gas, the steaming had got to be stopped at an earlier stage, because they would otherwise reduce the value of the heat products below the value at which they could be distributed, and then add water gas to make up the loss of heat value. This meant that Solar oil had to be purchased for the purpose; and what was the use of taking 2 or 3 gallons of Solar oil, which was obtained from America, and cracking it into petrol to be added at the one end, while they took the benzole out at the other end? It would be much more sensible for the gas-works to put down small oil-cracking plants to crack the Solar oil, put the rich gases into the coal gas, and return the cracked petrol to the motor industry. With regard to low-temperature distillation, why was the motor industry to be everlastingly dependent for its fuel upon the bye-product of some other industry? If low-temperature distillation had been able to prove itself, there would be no need for any compulsion, such as was suggested in the paper, as to the prohibition of the use of raw coal. The one remedy for the motor industry was in the manufacture of alcohol.

Major H. R. ARMSTRONG agreed that they should not look to the carbonization of coal for the sake of the benzole that was to be obtained from it. Attention should be directed to the carbonization of coal into its most economical products. The Fuel Research Board were carrying out most valuable work in this connection not only on a laboratory but on a commercial scale.

Prof. W. A. BONE said it was a question whether the problem of transport should not be considered from another point of view from that of burning oil fuel—whether attention should not be directed to the design of machines for road transport which would burn a compressed or prepared solid fuel from coal, and whether the straining after further supplies of oil fuel was not after all pursuing a will-o'-the-wisp. He referred to the development of alcohol manufacture from coke-oven gases, as mentioned in the last report of the Fuel Economy Committee of the British Association, and added that he did not think the report did sufficient justice to the work being done at the Skinningrove Iron-Works, Yorkshire. He fully agreed with those who thought that low-temperature distillation was a very important subject, and ought to be followed further. He was not at all satisfied that the technical failures hitherto justified discouragement. He believed the time was coming when such advances would be made as would bring low-temperature distillation as a commercial proposition on to a different plane from what it had hitherto occupied. He was not at all pessimistic of the future, and believed that the next few years would see not only a thorough control of the subject, but he thought there was every likelihood of successful developments. There was one omission in the paper which was significant. In various parts of the Empire there were enormous deposits of lignite or brown coal, which had not been referred to. He had received samples from various parts of the dominions; and the oils he had obtained from them could be seen at his laboratory. There were great potential sources of motor spirit in these coals. The whole problem of lignite ought to be thoroughly investigated.

Mr. SHRAPNELL-SMITH, in the course of his reply, agreed that the motorist must not expect to get his fuel at the expense of jumping into a particular class of undertaking before it was thoroughly proved. His contact with those concerned with low-temperature carbonization had been such that they were quite prepared to admit that while they believed the plant they now had in course of completion was the very one which would do the trick, yet they were not yet ready to say that it would answer the full working conditions which such a plant must do before it could be said to be capable of being a commercial proposition. At the same time, from what he had seen, he felt he could endorse the claim for low-temperature carbonization. It was very much more advanced than it was fifteen months ago; and it was very near to the point of achieving the success which everybody wished to see. As to the work at the Skinningrove Iron-Works, there had been a great deal of reticence about this; and it was very difficult for any official or non-official body to endorse a process if the information concerning it was not available.

Nottingham Meter-Rents.—The perpetuation in Nottingham of the system of charging meter-rents has long given rise to considerable criticism, which has become strongly emphasized during the campaign connected with the municipal elections; but the policy has on more than one occasion been defended on the score of forming a useful source of revenue. Mr. Arthur Hayday, M.P., one of the principal leaders of the labour party in the city, has, however, suggested that the Corporation's attitude is about as sensible as it would be for a tradesman to charge for the use of his scales. For the financial year ended March last, the accounts show that the rental of meters in Nottingham and the district covered by the undertaking brought in £6919, an item which cannot be treated as negligable. Still, the feeling of discontent in regard to the continuance of an arrangement which finds little favour in many other towns has become very pronounced in Nottingham.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

One Farthing or 0·2d. Movements per Therm.

SIR,—The discussion on the above really resolves itself into a question as to what will or will not puzzle any simple-minded consumer who is desirous of knowing the complete selling price of gas with all its attached oddments.

Personally I agree with you, Sir, in your leader of the 6th inst., in which you say: "We do not think the public will concern themselves much over what appears after the whole number per therm." The official whose duty it will be to deal with any consumer anxious for fuller details will in any case have to explain the decimal portion of the therm quantity of gas; so that the same instructive information that will be hazarded will also cover the decimal difficulty in regard to the price. With all due respect to Dr. Carpenter, I am still firmly of the opinion that the 0·2 of a penny is the method which will appeal to the large majority of the accountancy staffs of the gas industry; and I may say that evidence of this has been forthcoming since the idea was first mooted. I, however, quite agree with Dr. Carpenter that the price in the future will probably move by larger stages than the equivalent of 1d. per 1000 c.ft. But, even so, there will be an advantage in having the smaller fraction of the penny to deal with, as there will be a larger number of movements possible within the same range of prices.

There is another reason why the 0·2d. should be adopted in favour of the farthing, and "Engineer" touches upon the point which I desire to make. It is thought that owing to the fact that very few companies will be able to show the exact calorific value of the gas they supplied in pre-war times, it may be necessary for the authorities to assume a standard for this purpose, although of course some attempt may be made to arrive at a figure on the basis of the illuminating value of the gas supplied. I imagine that an arbitrary figure will be adopted; and this may very well be 500 B.Th.U., but certainly not such a low figure as 400 B.Th.U. Should the figure of 500 be adopted the 0·2d. will exactly fit every such case, so far as the translation of prices is concerned, from per thousand cubic feet into per therm. A system therefore of charging per therm by stages of 0·2d. would require no adjustment to the sliding-scale dividend. It may be that however strongly Dr. Carpenter may plead for the use of the farthing on sentimental grounds, the matter will be settled by expediency, which will inevitably bring about the adoption of the 0·2d. per therm as the future movement in price.

H. E. IBBS.

The Gas Light and Coke Company, Westminster,
Oct. 22, 1920.

Benzole Extraction and Reduction of Naphthalene.

SIR,—In reply to Mr. Copp's letter referring to the benzole plant at these works, which I described in my Presidential Address to the North of England Gas Managers' Association, I had not seen a description of the plant at the Etruria works, and was not aware of the resemblance referred to.

I simply described our own plant and the method of working, the results from which, as far as the removal of naphthalene from the gas is concerned, are very similar to those obtained by Mr. Copp's plant erected at an earlier date, except that I see, on referring to his paper, he is able to eliminate the whole of the naphthalene from the gas, which we have not been able to do.

ARNOLD W. BRANSON.

Hartlepool Gas and Water Company,
Oct. 23, 1920.

Extra Charge for Washed Coal.

SIR,—With reference to the remarks in your last issue *re* the above, the impression they give is that the action of the Central Executive Board of the National Gas Council was the cause of the increase of 2s. 6d. per ton being nullified.

As a matter of fact, I was at the meeting of the South Yorkshire Coal Trade Association, when the members present decided not to take advantage of the proposed increase in price.

TINSLEY PARK COLLIERY COMPANY, LTD.,
per J. H. W. LAVERICK, Managing Director.

Tinsley Park, near Sheffield, Oct. 25, 1920.

School Children to be Taught to Save Gas.—In consequence of the shortage of natural gas and the serious situation in the artificial gas industry, due to the scarcity of oil and coal, Governor Cox, of Ohio, has issued a proclamation through the Bureau of Mines of the Department of the Interior, pointing out the need for stringent methods of conservation, and requesting school teachers to urge upon their pupil, the necessity and importance of exerting every possible effort to conserve the use of gas. He further requests the teachers to acquaint themselves with the various methods whereby gas may be conserved, and to impart this information to the pupils, that it may be carried into the homes.

New Gasholder at Stafford.—The Mayoress of Stafford (Mrs. Blumer) last Saturday performed the ceremony of turning the gas into the new holder which has been erected for the Stafford Corporation Gas-Works, at a cost of about £15,000; the holder being part of a scheme of extensions which the Town Council sanctioned some time ago. Mrs. Young (wife of the Chairman of the Gas and Electricity Committee) opened the valve by which the gas was turned into the mains. The new holder has a capacity of a million c.ft. of gas. In the course of an address, the Chairman of the Committee said the increase in the output of gas from the works had been so large that the Committee were again faced with the necessity of further extensions; and additional carbonizing and purifying plant would have to be installed at a very early date.

REGISTER OF PATENTS.

Constant-Level Gas-Meters.—No. 141,697.

COMPAGNIE POUR LA FABRICATION DES COMPTEURS ET MATÉRIEL D'USINES À GAZ, of Paris.

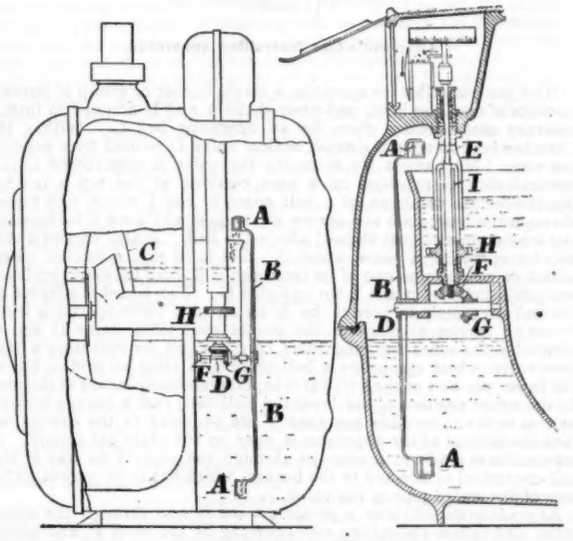
No. 10,000; April 9, 1920. Convention date, April 11, 1919.

This invention relates particularly to the type of meter in which an elevating device constituted by a wheel or arms provided with buckets, and driven by the measuring wheel, lifts water from a reserve tank and pours it into the measuring wheel tank.

It is pointed out that the evaporation of water in wet meters causes errors of measurement if the level happens to fall to the top of the central opening of the measuring wheel—the gas then passing entirely from the inlet to the outlet without its volume being registered by the apparatus. To obviate this, it has been proposed to maintain the correct water level by an elevating device operated by the measuring wheel and adapted to continually pump or scoop up a quantity of water from a spare reservoir. A portion of the water compensates for the water lost by evaporation, and the superfluous water falls back in the reservoir by an overflow which is used to adjust the level of the water limiting the measuring capacity of the wheel.

Other arrangements are constituted by a wheel or cups, also operated by the measuring wheel, but with a speed reducer which diminishes the motor's effort. In this case, either the cups have their centre of oscillation above the axis of the wheel, and can draw water from only a small depth below the axis—thus limiting the capacity of the spare reservoir unless the dimensions are out of proportion to the size of the meter—or else the centre of rotation of the system is brought below the axis of the wheel by gearing, the working of which is complicated and uncertain.

According to the present invention, a wheel or worm on the vertical axle of the registering train of wheels is caused to operate a water-lifting device consisting of a wheel or arms provided with cups dipping into a reserve water-tank and raising the water in some well-known manner.



A French Constant-Level Gas-Meter.

The illustration is a sectional view of a meter fitted with the elevating device and the device in vertical section, with its adaptation to another type of meter.

The elevating device comprises one or more cups A fixed on the periphery of a disc or wheel B to which the measuring wheel C of the meter communicates a movement of rotation about an axis D, placed appreciably below the centre of the measuring wheel, and in such a position that the cups can draw water from the spare reservoir down to a very low level corresponding to the quantity of reserve water required to avoid the necessity of too frequently refilling the meter. This result is obtained by a special arrangement by which use is made of the vertical axle E for the operation of the elevating device. The axle receives its motion from the axis of the drum to transmit it to the hands of the registering mechanism, as is the case in ordinary wet meters.

The elevating device is driven by a worm on the axle of the measuring wheel of the meter engaging a helical gearing wheel on the vertical axle, which drives the disc B or the arms or wheel carrying the cups by means of two bevel wheels, one of which F is fixed on the vertical axle and the other G on the axle of the disc-wheel or arms carrying the cups.

This method of driving the cups comprises a helical gear wheel H fixed on the vertical axle, and gearing with the worm of the measuring wheel. The helical wheel, instead of being fixed as usual on the portion of the axle facing the worm, has a long hub the upper part of which constitutes the joint of the wheel H with the vertical axle. This hub is hollow, so as to fit over the tube V about which the helical wheel revolves, and through which the vertical axle passes in order to penetrate into the spare reservoir so as to receive the bevel pinion F, gearing with the pinion G fixed on the axle of the wheel carrying the cups. By this arrangement any leakage of water through the bearing of the axle E is prevented, since the tube I prevents the water having

access to the bearing. The connection between the axle of the measuring wheel and the elevating device is thus established without any complication of parts and without the possibility of the water of the wheel tank falling back in the spare reservoir otherwise than through the overflow, since the tube surrounding the vertical axle prevents any leakage at the place where the measuring wheel tank is bored for the passage of the vertical axle.

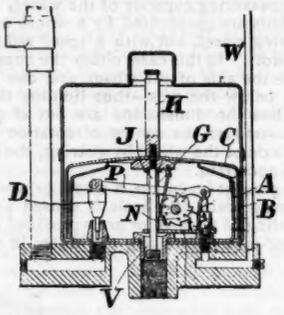
The arrangement thus constituted has (it is claimed) numerous advantages, resulting from the utilization of the vertical axle existing in all the meters to operate (together with the registering mechanism) an elevating device of small dimensions. This allows one to draw the water of the spare reservoir down to a very low level, since it is sufficient for the cups to describe a circle of small radius in order to be able to draw the water from the lower portion of the apparatus to pour it in the wheel tank.

Gas Controlling Apparatus.—No. 150,777.

ANDERSON, J., of Edinburgh.

No. 13,609; May 29, 1919.

This invention relates to the control of the supply of gas to lighting and extinguishing apparatus.



Anderson's Gas Controlling Apparatus.

The gas controller for operating a single burner or group of burners consists of cast-iron inner and outer shells A and B adapted to form a mercury seal between them for an operating bell C. Within the chamber is suspended a ground conical valve D guided by a depending stem. Mechanism for actuating the valve is constructed of two vertical rods G mounted on a base carrying at the top a bracket pierced for the reception of a bell operated rod J which also passes through the base plate and carries at its upper end a nut K for locating the loading means [not shown] above the bell. It also carries a stirrup for operating a phase wheel N—that is to say, a ratchet wheel which carries pins on one of its faces and is pivoted between two brass rod projections from the main uprights G. The wheel is adapted to lift and alternately to permit the lowering of a valve-operating lever P, which carries at one end the burner controlling valve D and is pivoted at the other end, and there carries a pin for operating a bye-pass valve, which comprises a ball tending to close an orifice, but in the lower position of the valve D is kept therefrom by means of the pin. In the upper position of the lever the ball falls into a seating formed by this orifice. Suitable gas-ways V are provided in the casting, so that the interior of the apparatus is open to the main gas supply. A connection is made to a pilot jet through the pipe W by way of the ball-controlled orifice and to the burner, which has to be controlled by way of the sealed pipe of the valve D.

At predetermined times a pressure wave is sent through the apparatus, and causes the raising and lowering of the lever P, and therefore opening and closing of the burner valve D by means of the operation of the phase-wheel. In the form illustrated, the valve is adapted to be opened by one pressure impulse; maintained open during the next impulse; closed by the succeeding impulse; and so on.

The lever is maintained in the raised position by resting on one of the pins on the face of the phase wheel, and in its lower position by resting on two pins (although this arrangement of pins may be modified). With the lever in its upper position, gas is free to pass to the controlled burner, but the bye-pass port is closed. In its lower position the burner is shut off, but a passage is open to the pilot jet through the bye-pass. In both positions a full mercury seal is obtained, because after each pressure wave has subsided, the bell falls to its normal level.

Safety Valves in Connection with Gas-Distribution Systems.—No. 150,779.

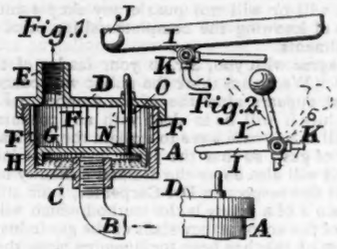
MITCHELL, E. A., of Cannon Street, E.C.

No. 13,745; May 30, 1919.

In high-pressure gas distribution systems embodying governors, the patentee points out that a mercury seal is usually adopted to conduct gas from the low-pressure or consumption side of the governor directly to the atmosphere exterior to the space occupied by the governor, wherever, for any reason, the pressure on the consumption side exceeds a predetermined value. As ordinarily constituted, however, in the event of a breakdown in the governor a mercury seal may be impaired due (say) to the mercury being discharged with the escaping gas, in which case the escape may be intensified and result in serious loss, if occurring at a time when no one is available to interrupt the high-pressure supply.

The present invention has for its object to obviate any such disadvantages. Broadly, it consists in the provision of a liquid-luted bell-shaped float, movable within a vessel so as to liberate fluid upon momentary excess pressure; a valve adapted to interrupt the supply of fluid to the system under control; and means adapted to close the valve in the event of a large excess of pressure and its continuation for a period greater than will allow of its being rapidly relieved by the float.

Fig. 1 shows in vertical section one construction of safety valve according to the invention. Fig. 2 is a detail showing a modification.



Mitchell's Safety Valve for Gas-Mains.

In the example shown, the safety device comprises a cylindrical vessel A having a central pipe connection B at the bottom, leading to the low-pressure side of a gas regulator. The pipe connection B terminates in an upstanding rim or ledge C, so as to form, with the vessel, an annulus for the reception of mercury. The vessel is provided with a screwed cover D having an outlet branch E by which escaping gas can be conducted away, and has grooves F extending from or near the top of the vessel to within a suitable distance of the top of a float G consisting of a disc having a downwardly extending rim or margin H adapted normally to enter the mercury, as shown. The disc or float is a relatively free fit in the vessel, and upon a momentary small excess of pressure in the pipe B, above a certain value, will be moved upward a distance sufficient to establish communication between the spaces above and below it by way of the groove or grooves F in the wall of the vessel, so as thereto to allow of the escape of gas and a reduction of pressure to the normal value, before it can make its full upward stroke, after which it will again descend and seal the outlet. In the event of any great excess of pressure, and its continuation for a period longer than will allow of its being rapidly relieved by the escape of gas through the grooves F to reduce the pressure to the normal, the float will be raised to its full extent, in doing which it is caused, by a pin through the cover, slightly to tilt a lever, one arm I of which is normally weighted by a ball or roller J, so that motion of the lever thus initiated is continued by the ball or roller travelling to the end of the opposite and longer arm of the lever, and thus increasing the movement.

The movement of the lever I may be transmitted to a stop-cock controlling the gas supply by (for instance) the fulcrum of the lever being constituted by the movable plug of a stop-cock at K controlling the supply of high-pressure gas. The tilting of the lever may be effected by a pin on the float G extending through a hole in the cover of the vessel, at which point there is consequently a joint communicating with the place in which the safety valve is situated. With leakage of gas due to momentary excess pressure there would be no appreciable entry into the room of the escaping gas, but with a heavy and sustained discharge of gas, entry of it into the room is entirely prevented by providing means for sealing the joint when the float G is raised. Such means may comprise a washer N surrounding the pin and a comparatively sharp-edged annular rim or seating O upon the cover with which the washer can co-act.

Registering, Recording, and Receipt-Issuing Apparatus for Gas-Meters.—No. 151,189.

GUSTAFSSON, C. A., of Malmö, Sweden.

No. 31,695; Dec. 17, 1919.

The inventor remarks that in municipal gas and electricity works, where numbers of subscribers are attached to a common distributing network, very extensive book-keeping and checking systems must be used for controlling the consumption of energy and for collecting the debts. In order therefore to save time and personnel, it has been proposed to provide each consumer with counting apparatus operated by the meter—comprising type wheels co-acting with a moveable printing pad for recording the monetary value corresponding to the consumption at a fixed rate of charge upon a receipt or account blank inserted into the meter by some one authorized to operate the device and issue a receipt or account, whereafter the counting apparatus is automatically reset to zero.

The present invention has for its object to provide more efficient apparatus of the kind—mainly characterized by the fact that the printing pad is moveable to and from the type wheels by means of a crank and gearing, and that within the apparatus between the type wheels and the printing pad is arranged an open frame, which may be given, by suitable means from outside the apparatus, a reciprocating movement across the path of the printing pad to and from an opening in the casing surrounding the apparatus, so that receipt blanks may be inserted therein and brought in printing position between the wheels and the pad without the frame being removed from the apparatus. The apparatus is connected with a meter, from which a number of impulses corresponding to the consumption act upon driving mechanism for the counting device of the apparatus in such manner that the latter is moved proportionally to the actual consumption.

According to a further feature of the invention, the apparatus is so constructed and arranged that individual subscribers are able at any time directly to read-off the costs to be paid for the consumption up to a given time without any knowledge of the apparatus which affects the

measuring proper of the consumption, or of the manner of calculating the cost of the consumption.

A specification extending to more than eight pages, accompanied by five sheets of closely lettered drawings, is needed to describe the invention.

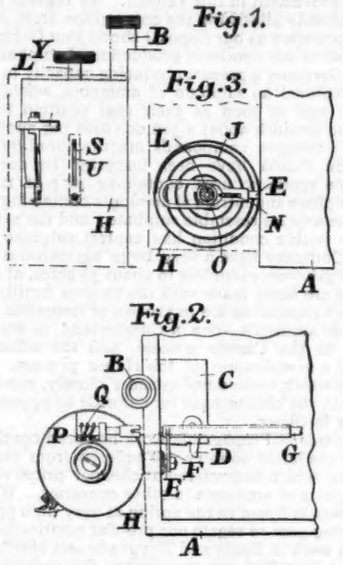
Prepayment Mechanism for Meters.—No. 151,066.

HART, J. T., of Fulham, S.W.

No. 14,859; June 12, 1919.

This invention relates to prepayment gas-meters embodying valve-controlling mechanism, consisting of two parts—one worked by the coin mechanism and the other by the meter mechanism.

It provides novel means for connecting the coin-pocket to the valve-actuating mechanism.



Hart's Prepayment Meter Mechanism.

Fig. 1 is a front elevation of a portion of a meter (the money-box being removed); fig. 2, a plan; and fig. 3, a plan with a portion of the coin mechanism removed.

A is the meter casing; B the gas inlet pipe; and C the valve-box which (as shown) is inside the casing, although it might equally well be placed outside. D is the valve lever, which is actuated to open the valve by a rod E and arm F worked by the coin mechanism, and which is actuated to close the valve by a spindle G geared to the index-worm of the meter.

The coin mechanism is contained in an upright cylindrical casing H mounted at the side of the meter. The mechanism for controlling the inlet valve comprises a pair of flat spirals J, formed on discs K, which are mounted loosely on the spindle L that carries the coin-pocket T. The flat spirals face each other; and the discs which carry them, or on which they are formed, are separated by a distance-piece, which may be attached to one of the discs.

Between the spirals, and gearing with both of them, is a pinion N carried by a radially movable frame O, to which is attached the rod E, which actuates the inlet valve. The upper disc K carries a toothed wheel geared through a worm Q with the spindle G of the meter mechanism, and is rotated when the meter is supplying gas. The lower disc K carries a toothed wheel adapted to be engaged by a pawl S pivotally mounted in the coin-pocket T, and under the control of the coins passed through the coin-slot U.

When a coin is passed through the slot into the coin-pocket, it lifts the pawl S into engagement with the toothed wheel; and when so engaged the wheel will be carried round when the coin-pocket is rotated. The coin-pocket is secured to the spindle L, and is open at the top and bottom and outer end. It is rotatable by turning a knob or handle Y fixed on the spindle. A cylinder is also mounted on the spindle L, and fits loosely in the casing—revolving with the coin-pocket within the casing when the actuating knob or handle Y is rotated. The cylinder serves to close the slot U, when the coin-pocket is moved away from its initial position opposite the slot.

Price of Gas in Newry.—The Newry Gas Committee have informed the Urban District Council that, though they recently increased the price of gas to the limit authorized by their Special Act, they will be unable to meet the large increase under various headings—chiefly coal and wages—without incurring a serious loss. They therefore ask the Council to obtain powers to increase the price of gas by 2s. per 1000 c.ft. beyond the present statutory limit.

Free Stoves and Cheaper Gas Advocated.—The Socialist party at Bradford have issued a general "Municipal Programme" for all their candidates. This includes free gas-stoves and meters for householders, the cheapening of gas and electricity, and a long list of other Utopian promises, some practical and more otherwise. The programme embraces the extension of the principle of direct labour (for which a municipal works department is proposed, to lead to the entire abolition of contract work), a maximum forty-hour week, two weeks' holiday with full pay, and limitation of work to six days per week.

MISCELLANEOUS NEWS.

SULPHATE OF AMMONIA ASSOCIATION.

Sixth and Last Annual Meeting.

The Annual General Meeting of the Association was held at No. 30, Grosvenor Gardens, S.W., last Wednesday—Mr. D. MILNE WATSON (the Chairman) presiding.

The following extracts are taken from the report which was then submitted:

The Executive Committee have pleasure in submitting to subscribers the sixth annual report of the Sulphate of Ammonia Association, with which is incorporated the twenty-third annual report of the Propaganda Committee, together with a statement of accounts for the financial year ended June 30, 1920. We indicated in our last report that suggestions for the formation of a Sulphate of Ammonia Corporation had been put before the makers, and had met with an encouraging reception. We are now pleased to be able to state that these proposals have been definitely accepted by producers representing about 90 p.ct. of the annual production, and that the British Sulphate of Ammonia Federation, Ltd., as the new body is called, was registered and commenced in June, 1920. The coming into being of the Federation has completely changed the aspect of sulphate of ammonia affairs in this country; and the question arises as to whether the Association should continue to exist as a separate entity. We think that there is a general feeling among members of the Association who have joined the Federation that redundancy should be avoided, and that the Federation, with its clearly defined constitution, is in a much better position than the Sulphate of Ammonia Association to carry out propaganda as well as selling work. In the circumstances, therefore, we have decided to request members to pass a resolution at the annual meeting, to which this report will be presented, agreeing to a voluntary winding-up of the Association on the understanding that the Federation will continue to carry on our propaganda work.

It will be seen from the balance-sheet that we have an accumulated fund amounting to about £13,000; and we propose to ask the annual meeting to pass a resolution handing this sum over to the Federation to be spent on propaganda work. In the confident expectation that subscribers will agree to this resolution, we desire to take the opportunity of wishing the Federation every success in its future enterprise. The imminent prospect of our own dissolution does not lessen our satisfaction that a new and stronger organization has risen, Phœnix-like, from our ashes. We think it augurs well for the future of sulphate of ammonia that the co-operative design underlying the constitution of the Federation should have received the assent of such an overwhelming majority of the producers in this country. The Federation wields a greater power than the Association could ever have exercised; and its operations should enable British sulphate of ammonia to compete on more favourable terms with foreign competitors than has been possible in the past. We have received help and support from so many makers that it is impossible to make individual acknowledgments; but we desire to express our special thanks to Scottish Oils, Ltd., the North Eastern Bye-Products Association, the Scottish Ironmasters' Federation, the Cumberland Coal Owners' Association, the Yorkshire Group of Coke-Oven Producers, and also to the National Gas Council for the important part they have played in the formation of the Federation. Many members of the Association have been elected members of the Committees of the Federation; and we feel sure that they will see that the good work done by the Association in regard to propaganda, both at home and abroad, is continued. The work of the Association during the past year may be grouped under the following headings.

Equalization Scheme.—The arrangements of last year have been continued, and a total quantity of 121,494 tons of sulphate of ammonia has been dealt with for export under the scheme; the total sum realized being £3,301,258. The total surplus distributed up to the present time amounts to £709,008. The participating tonnage was 339,105 tons; and each maker has therefore received £2 1s. 10d. per ton on his whole production in addition to the average home price. The above figures are subject to some increase, as the Ministry of Agriculture inform us that there will be some saving on the average estimated cost of home deliveries. No payments were made to the Ministry of Munitions, as in the past year; and it was decided to discontinue to bring home industrial sales into the pool, the amount of such sales being very small. The export business has again been done through the sulphate of ammonia export traders, who have received a total sum of £47,918 for their services; this representing 1½ p.ct. on the f.o.b. price in single bags. The effect of American competition was very marked during the summer months of 1919. At that time, Americans had a large stock of sulphate of ammonia, and accepted prices as low as £20 per ton. Their strikes at the latter portion of the year made a material difference to the situation, and resulted in our obtaining a share of the Japanese business for the spring at the record price of £55 per ton c.i.f. Prices in Spain during a short period in the spring were also very high, up to £64 per ton having been paid. The results shown by the equalization scheme would have been considerably better had it not been for the unfortunate strikes in Yorkshire during the summer, and the prolonged stoppage at the shale-oil works in the autumn of 1919.

Agricultural Deliveries.—The Manager and staff returned to Horseferry Road from the Ministry of Agriculture in June, 1919; and the whole of the home agricultural deliveries during the year under review were arranged under the Association's head office. We reproduce last year's table brought up to date. From this it will appear that the home agricultural consumption of sulphate of ammonia was well maintained during the past season, in spite of the fact that far larger quantities of nitrate of soda were available than during the previous season. The total quantity of sulphate of ammonia delivered was 233,500 tons. Scotland consumed 71,900 tons, Ireland 42,000 tons,

England and Wales, including the Isle of Man and Channel Islands, 119,600 tons, as against 67,500, 35,000, and 166,500 tons respectively the previous season. The chief competition came from nitrate of soda, and the activities of other nitrogenous fertilizers were dormant.

	Total Production of Ammonia as Sulphate of Ammonia.	Production of Sulphate of Ammonia as such.	Exported.	Used for Home Agricultural Consumption.	Nitrate of Soda used for Home Agricultural use.
1913 . .	432,600	*372,000	324,700	* 40,000	*80,000
1914 . .	426,400	*363,000	313,900	* 50,000	*80,000
1915 . .	426,300	*350,000	294,300	* 64,000	*40,000
1916† . .	433,700	315,500	160,300	144,600	* 5,000
1917† . .	458,600	283,500	28,500	234,000	* 5,000
1918† . .	432,600	331,500	38,400	269,000	*10,000
1919† . .	397,500	361,360	118,970	233,500	*40,000

* Estimated. The nitrate of soda figures are only rough estimates.

† The figures relate to the "fertilizer" year commencing June 1 in each year.

Propaganda Work.—The work has been continued in England and Wales under the supervision of Mr. A. O. Blackhurst, assisted by Mr. P. H. Hay, Mrs. Robinson, Miss James, and the staff at Preston. All members of the propaganda staff have done excellent work, and have displayed originality in developing new ideas, and energy and resource in carrying them out. The Register of Agriculturists has been completed and kept up to date, with the result that we have a very comprehensive circularizing list.

Experiments.—We were again successful in persuading a number of agricultural colleges to make experiments for us—namely, the Harper Adams Agricultural College in Shropshire, the Monmouth Agricultural Institution at Usk, and Wye College in Kent—42 experiments altogether on various crops have been arranged in England and Wales. In addition to this, the plots at the demonstration centre at Ormskirk have been carefully watched, and interesting results obtained. The information derived from these experiments will be used in the literature for the coming year. As in previous years, regular visits have been made to Rothamsted by members of the staff, who have on every occasion been most courteously welcomed by Dr. Russell and his assistants.

Prize Competitions.—In accordance with the Committee's decision, the National competition was abandoned; but in view of the fact that the Royal Agricultural Show was to be held at Darlington, it was decided to offer prizes for cereals and roots to competitors in Northumberland, Durham, and Yorkshire. Unfortunately, the number of entries received was very disappointing—only amounting to 15 in all three classes. It was therefore decided to abandon the competition. This experience seems to show that the Committee were wise in abandoning these competitions. They appear only to attract the best farmers who farm the best land; and to this extent they do not show a return commensurate with the outlay.

Joint Propaganda with French Producers of Potash.—An arrangement has been made with the Alsace-Lorraine Development and Trading Company, Ltd., for joint propaganda in favour of sulphate of ammonia and sylvinite (French potash salt). Experiments have been made with sulphate of ammonia and potash, and exhibits illustrating the effect of the two fertilizers have been shown at the shows throughout the country.

Ireland.—We are pleased to be able to report a further expansion in the Irish trade in the year ended May 31, 1920; the total quantity delivered amounting to 42,000 tons. Propaganda work was continued in the counties of Waterford, Cork, Kilkenny, Louth, Dublin, and Armagh, and special attention has been devoted to working-up consumption in the South. An oat competition was held for the North of Ireland, in which there were 26 entries, and some crops of very high standard were grown as a result. Competitions were also held in connection with Local Societies in co. Wexford and co. Down. Advertising was reduced to a minimum, in view of the absence of any serious competition to sulphate of ammonia—40,000 copies of a booklet entitled "Farm Profits," written by Mr. Irwin, were distributed throughout Ireland. The following remarks in Mr. Irwin's annual report will be of interest:

> "A bag of neutral quality was displayed at our stand in Belfast Show (26th to 28th May), which perhaps was a mistake, as everyone who examined it was very keen to get some; and I understand the production of this quality is very limited. With regard to quality and packing, the Irish trade demands the very best of both, as the sulphate has to stand from eight to ten handlings before it reaches the farmer's cart. The change, in this respect, during the past couple of seasons has been very great, as we used to be asked regularly for 24½ p.ct.; but now if any quality is stipulated it is always the highest—and neutral if possible."

In spite of the troublous times through which his country is passing, Mr. Irwin has carried out the programme which we mapped-out for him at the beginning of the year, which we think is a great tribute to his zeal, pertinacity, and tact. He has also been of great assistance to us in arranging supplies when difficulties occurred.

Scotland.—The work was resumed in June last by Mr. J. D. Young; and new offices have been secured at 29. St. Vincent Place, Glasgow. The work is under the general supervision of the Scottish Propaganda Committee, consisting of Mr. William Fraser (Chairman), Mr. A. K. M'Cosh, and Mr. J. F. Sutherland. The Committee decided to devote special attention to the Northern Counties of Scotland, and thirty experiments have been arranged in the counties of Ross and Cromarty and Sutherland on grasses, cereals, and roots. Four prize competitions have been organized in the counties of Fife, Forfar, and Lanark. Mr. Young has carried out his work to the complete satisfaction of the Committee.

Committees.—Messrs. Richard Ainscough, Walter Martland, and J. Ellis Potter have continued to assist the Preston staff throughout the year; and we wish to take this opportunity of thanking these gentlemen for the very valuable help they have afforded to the Association. The Propaganda Sub-Committee, consisting of Messrs. A. Stanley, F. J. Mason, and Alderman F. S. Phillips, have continued to hold regular monthly meetings, and have directed the propaganda work in detail. We again wish to express to this Sub-Committee, and especially to Mr. Stanley, their Chairman, the very best thanks of the Association for all the enthusiasm, time, and trouble they have given to their work.

Technical Developments.—There has been a slight increase during the year in the production of neutral sulphate of ammonia; but in view of the increased competition being experienced from American, Dutch, and German sulphate of ammonia, it is most desirable that every large maker in the country should now adopt some neutral process. A useful memorandum issued by Mr. E. J. Fottrell, the Manager of the National Gas Council, in conjunction with Mr. D. V. Hollingworth, which appeared in the "GAS JOURNAL" for March 9, 1920, calls attention to the serious wastage of ammonia going on at a number of works; and the Alkali Inspector's fifty-sixth annual report also testifies to the need of considerable improvement in this respect. As regards overseas countries, we have already alluded to the competition from America. The most recent information at our disposal shows that Germany is rapidly recovering as far as her synthetic production of sulphate of ammonia is concerned. Germany's present producing capacity in various forms of nitrogen, calculated as sulphate of ammonia, would appear to be 1,500,000 tons; and as soon as their coal position improves, they should be able to produce about 2,500,000 tons per annum. Samples of new synthetic nitrogen compounds manufactured by the Badische Anilin und Soda Fabrik have been inspected by our staff. Chief among these are synthetic urea, containing 46 p.ct. nitrogen, and a compound of sulphate and nitrate of ammonia containing 25 p.ct. nitrogen. Both these articles resemble sulphate; and the samples showed material in fine friable condition like neutral sulphate of ammonia. The Badische Company have a very large agricultural experimental station at Ludwigshaven, extending to about 30 acres, at which exhaustive experiments are being made with the various fertilizers they produce. Two large companies are in process of formation in England to produce synthetic ammonia—one in Cumberland, to work the French method known as the Claude process, and the other at Middlesbrough, to instal a modification of the Haber process. The Federation will have to watch these developments closely, more particularly in connection with the claims made for chloride as opposed to sulphate of ammonia as a fertilizer.

Foreign Propaganda.—Propaganda work has been continued in Spain and Egypt. In the latter country, we suffered from the competition of nitrate of soda, which was offered at cheaper prices than were obtainable for sulphate of ammonia in other countries. We were able to do a good business in Spain in the spring at very high prices; and we hope in the coming year to regain our pre-war position in that country. The propaganda work in Spain and Egypt consists chiefly in maintaining direct touch with cultivators throughout the country by means of personal visits, supplemented by judicious newspaper advertisement and experiments. We had a stand at the Federation of British Industries' Exhibition at Athens; an attractive exhibit was arranged by our Egyptian office; and 10,000 copies of a pamphlet in Greek were distributed. Orders have since been received from Greece for about 600 tons of sulphate of ammonia.

Staff.—The Executive Committee again wish to place on record their appreciation of the work done by Mr. F. C. O. Speyer (our Manager), Mr. H. Jones (our Secretary), and the staff of the Association generally. Mr. Speyer has devoted himself wholeheartedly to the affairs of the Association; and his zeal and ability are largely responsible for the successful year's working and for the foundation of the new Federation, on which our hopes for the future success of sulphate of ammonia are centred.

Accounts.—We are pleased to be able to inform subscribers that our negotiations with the Ministry of Agriculture resulted in their paying the full amount of our claim against them. Our accumulated fund has therefore suffered no depletion, in spite of the difficulties encountered during the war, and now stands at £13,000. Should subscribers decide to keep the Association in being, Messrs. Wood, Drew, and Co. offer themselves for re-election as Auditors.

THE CHAIRMAN'S SPEECH.

The CHAIRMAN said the report dealt very fully with the activities of the Association which, he thought they would agree, had once again been both manifold and successful. The surplus derived from exports under the equalization scheme amounted to nearly three-quarters of a million sterling, and would have been considerably larger had it not been for the various strikes which occurred in the summer and autumn. This was a substantial contribution by the Association to the trade. Brief reference was made in the report to the American competition, which they had to face in the summer. The reference gave no adequate idea of the magnitude of the crisis they then had to face; and he could assure them that the members of the Equalization Committee and the Manager spent some anxious weeks during the summer of 1919. There were times when the orders in hand for home and export were only sufficient to provide an outlet for production a few weeks ahead, and when it seemed difficult to see whence further orders were to come. But by spreading the orders they had among the different makers, they were able to keep the works going during the critical weeks; and through being in a position to act quickly and silently, they were able to meet the American competition and keep together their connection in foreign markets, without anything like a disastrous fall in prices. He thought it a fair point to make, if he asked "Where would prices have been after such a crisis if there had been no Association and no equalization scheme?"

Turning to the home trade, at first sight the figure of 233,000 tons looked disappointing compared with their high-water mark of 269,000 tons in 1918. But they would be interested to hear that the Ministry of Agriculture's estimate of requirements was only 200,000 tons; so that they sold 33,000 tons more for home use than was expected, notwithstanding the smaller average of land under the plough and the fact that nitrate was plentiful. While this was encouraging, and showed that sulphate was popular, they did not intend to adopt a complacent attitude. Their watchword for the future must be: "Expand the market both at home and abroad—especially at home."

He wished to repeat once more that mechanical condition and quality were prime factors in the expansion of sales. He was pleased to be able to report that there had been considerable progress in improving the quality at many of the largest works during the past twelve months. The production of neutral quality now amounted to about 30,000 tons per annum; but there was room for great improvement at the smaller works. Of course, he knew that for the very small units the alteration and adaptation of plant represented a formidable expense; but he urged the owners of moderate-sized plants, producing 1000 to 2000 tons per annum, to adopt a neutral process as soon as possible.

There would, he thought, always be a market for a limited quantity of low-testing sulphate among fertilizer manufacturers in this country. But the point was that inferior quality only commanded a restricted market, and if any crisis occurred it immediately became unsaleable. He was not exaggerating in saying this. They had ample evidence, especially from Scotland, that many farmers, who bought sulphate for direct use, refused to take anything but neutral quality—it was not a question of price. The farmer wanted the material in the best mechanical condition; and if he could not get it, he would buy something else.

It would be noted that he was devoting many of his remarks to future problems, although they were met there to carry out the obsequies of the Sulphate of Ammonia Association—for he assumed that the resolution in the agenda paper would be agreed to. He spoke of the future because he believed that their future was assured by the formation of the British Sulphate of Ammonia Federation, Ltd.; and he felt that, like Sir Henry Campbell-Bannerman on a celebrated occasion, he might adapt the famous old saying and cry "*L'Association est morte—Vive l'Association!*"

The formation of the Federation, representing as it did about 90 p.ct. of the British production, was the most important event which had taken place in the history of sulphate of ammonia in this country. Now at last British producers could speak with something like one voice; and he thought he might safely say that, through the Federation, they had once again become the dominating factor in the world's market.

Their efforts had been watched with close attention, both on the Continent and in America; and if, on the one hand, their rivals saw that they were in a better position to compete with them than before, yet, on the other hand, they felt that now there was one body in Great Britain with which they could make arrangements of a binding character. This was notably the case with their French friends across the Channel.

Thus far, then, he thought they had good grounds for satisfaction and for optimism. But he would not be doing his duty if he did not point out that they must be prepared for very greatly increased competition from other forms of nitrogen and synthetic sulphate in the near future; and he did not think it would be possible to maintain prices at their present level. The prospect of rising costs and falling prices was not a cheerful one—it should stimulate them to explore every avenue which led to economy in methods of production and working. The report drew attention to some recent publications on this matter.

He would like to say a few words about the resolution which appeared on the agenda paper. Whatever the future course of prices, they must assume that the production of sulphate would continue to increase. Every increase in production meant that wider markets must be found. To this end it was absolutely necessary that propaganda work should be continued. Both the Council and the Executive Committee of the Federation were unanimously of this opinion, and they have already made adequate provision for carrying on propaganda. He felt no hesitation, therefore, in recommending them to adopt the resolution transferring their accumulated funds to the Federation to be spent on propaganda work. This work succeeded best when it was reinforced by an active selling organization; and the Federation was in the best possible position to carry out such combined work.

In bidding farewell to the Association, their thoughts naturally turned to those far-sighted pioneers who founded the first Sulphate of Ammonia Committee in 1897. Of its original members, he was glad to see among them that day Mr. Isaac Carr, filled with undiminished enthusiasm for the good cause. And the great traditions which were inseparable from the name of William Fraser were still a living force in the land. The names of many another good man and true who had furthered their cause would readily occur to them—especially Mr. W. G. Blagden and Mr. Thos. Milne. Let them render their thanks to them all. Of the Sulphate of Ammonia Association, he thought they might say that, like many another good British institution, it had known how to adapt itself to the changing needs of the always interesting, and often arduous, times through which it had passed, and that it rose greatly to the great opportunity which presented itself during the war. *Tempora mutantur, nos et mutamur in illis.* In wishing the Federation "God-speed," let them remind it that it sprang from no mean parent, and that, without the patient work of 23 years done by the Association, it could never have started on its career supported, as it was, by an overwhelming majority of the makers.

The report and accounts were adopted; and it was afterwards resolved:

"That this annual general meeting of the subscribers to the Sulphate of Ammonia Association hereby agrees to a voluntary winding-up of the Association, to take effect immediately, and that any surplus assets available after settling all the Association's debts and liabilities (if any) be paid to the British Sulphate of Ammonia Federation, Ltd., of No. 30, Grosvenor Gardens, S.W., on the understanding that the Federation shall undertake to continue the propaganda work hitherto carried on by the Association, and to expend the sum of money received on such propaganda work."

Last Friday, 9000 men were rendered idle through the destruction by fire of the electric power cables supplying the various works of the Midland Railway Company at Derby. Fusing was supposed to have caused the fire.

THE LIGHTING, HEATING, AND POWER (EMERGENCY) ORDER, 1920.

A Modification.

The Secretary of the National Gas Council (Mr. E. J. Fottrell) sends a copy of the following letter that was addressed to all the members on the 21st inst.:

Lighting, Heating, and Power (Emergency) Order, 1920.

The attention of the Mines Department has been drawn to paragraph 3 of the above Order, which requires all gas undertakings to restrict supplies of gas for power purposes to 50 p.ct. of the weekly average quantity supplied for power in the four weeks last preceding the date of the Order—*i.e.*, Oct. 16, 1920.

It was pointed out to the Department that, in the first place, it was only possible in a very small number of cases for gas undertakings to restrict the quantity of gas consumed by power users; and, secondly, that only in a small number of cases was it possible for the users of gas for power purposes to know the quantity which had been used in the four weeks preceding the date of the Order.

The Mines Department quite appreciate the difficulty of the position, and will be satisfied if each individual undertaking will continue to read all meters at the usual periods, and will notify consumers whose consumption is in excess of that specified in the Order.

It is desirable in the case of gas companies to draw the attention of their local authorities to the impossibility of carrying out literally the provisions of paragraph 3; and in the case of municipal gas departments the position regarding the supply of gas for power purposes should be explained to the official who is responsible for the administration of the Order in their area.

EAST WEMYSS AND BUCKHAVEN GAS ARBITRATION.

The Case for the Town Council.

The case for the East Wemyss and Buckhaven Gas Light Company, Ltd., in an arbitration to determine the price to be paid for their undertaking by the Burgh of Buckhaven, Methil, and Innerleven was given in last week's "JOURNAL" [p. 148]. The case for the Town Council is now outlined.

The arbitration took place in the North British Station Hotel, Edinburgh, with Lord ASHMORE as Oversman. Mr. HENRY WOODALL acted as Arbitrator for the Town Council; and Mr. W. DOIG GIBB, for the Gas Company.

Counsel appearing were: Mr. ALEXANDER MONCRIEFF, K.C., and Mr. J. B. PATON (instructed by Messrs. W. & J. OGILVY SHEPHERD), for the Company; Mr. A. H. B. CONSTABLE, K.C., and Mr. WALTER T. WATSON (instructed by Mr. ROBERT LESLIE and Messrs. PEARSON, ROBERTSON, and MACONOCHIE), for the Town Council. Mr. J. A. STUART was Clerk and Legal Assessor.

Mr. *Alexander Taylor*, the Secretary of the Company, was re-called and cross-examined by Mr. CONSTABLE, by way of opening the case for the Town Council. Questioned as to transfers of shares that had taken place, witness said in 1917 there were only three transfers, of over 150 shares on each occasion. When executors were involved, he would be consulted as to the price at which the shares should be put up; and he generally followed the value of the previous transfer. There was really no guide, with so few transfers, as to what would be the market value. If the sellers were prepared to sell at a certain figure, then it was no business of his. The 7500 shares were in something over 100 names. The great bulk were held in lots of over fifty. Mr. A. Watson Taylor, the Director who had given evidence, bought in 1917 165 shares at 31s. 6d. each, and 63 shares in 1919, at 35s. each. He had also sold shares between the two dates at 25s. 3d.

Re-examined: Excluding transfers on death, the total dealings between 1908 and 1919 affected only 2403 shares, or about 200 shares a year.

The OVERSMAN: the highest price down to April, 1913, is 35s., for a parcel of 25. Then there is another on June 20, 1914, where 20 shares were sold at 36s. each. That is the highest price that appears on a transaction. You do not remember anything about that?

Witness: No, I do not recollect the circumstances.

When did the question of the acquisition by the Corporation first become publicly known?—We got official notice to treat about 1914, I think. Before that there was talk about it in the local papers.

Provost *Matthew Taylor* said that on May 26, 1913, the Town Council passed a resolution to adopt the Burghs Gas Supply Act, in order that they might themselves supply gas to the community. Before the resolution had been confirmed in the following November, they were negotiating with the Gas Company about terms of purchase; and they made what they considered to be a very reasonable offer, which was not entertained. The amount of this offer was £12,000. In March, 1914, formal notice was served on the Company under the Act that the Council were willing to acquire the undertaking as a condition of exercising the right to supply gas themselves. Following upon this, there was an embargo imposed by the Treasury upon local authorities raising money for such a purpose. In July, 1916, the Council made another offer, in the hope of saving arbitration. They suggested to the Company that they were prepared to fix the price of the undertaking at the sum of £15,498, subject to payment being deferred until they were free to raise the money. They were willing to pay interest on the money; but the offer was not entertained. The Treasury restrictions were removed in March, 1919.

Mr. MONCRIEFF (in cross-examination): Do you suggest that when you made the offer in 1916 of £15,498 you were offering a sum which you thought to be excessive, with the hope of avoiding arbitration proceedings?

Witness: After consulting our experts, this was the utmost they were prepared to advise us to offer.

Having in view the fact that in 1916 you raised your offer by £3498, do you still maintain that the offer of £12,000 was reasonable?—I think so.

Are you maintaining, as you maintain in your pleadings, that since the date of the notice to treat the undertaking has been carried on by the Gas Company on behalf of the Town Council?—As our custodians.

Is your case that, having been trading for you, they have to account for the profits they have made during these five years?—That is so.

And I suppose you are prepared to pay interest on the price ascertained, from the date of the service of the notice to treat?—It will be taken into consideration.

What interest do you suggest the price should bear, if interest is to be allowed?—I should require to consult the Committee.

Mr. WOODALL: You suggest that you are to have the profits made by the Company from the date of the notice to treat?

Witness: I should think that largely depends upon the decision of the tribunal. The circumstances are very exceptional. All along we have felt that it was better to try and come to some arrangement with the present suppliers.

Mr. MONCRIEFF: In view of the evidence given by this witness, I ask Mr. Constable what his position is, as to the question of interim management. He cross-examined none of my witnesses upon the claim that we have carried on the business on our own account.

Mr. CONSTABLE: I am not particular which way it is done. I think it will work out pretty much the same either way.

Mr. MONCRIEFF: Then I ask you to accept the alternative I offer, which is that we should carry-on for ourselves without interest.

Mr. CONSTABLE: I may say we will agree.

Councillor *James Galloway* said he had no idea, before this scheme of purchase came about in 1914, that the Company were not only paying a substantial dividend, but were also extensively increasing and improving their works out of the revenue of the undertaking. If the community had had such knowledge, he believed the scheme for acquisition would have been brought forward much earlier. The inspiration to purchase arose in a sense from the fact that the Company were carrying on a lucrative business, and making substantial profits; and in addition there was what was supposed to be the exorbitant price being charged by the Company for gas.

The OVERSMAN: What was it led you to think that the price was exorbitant?

Witness: Because we found on investigation that it was in many cases double and treble what was being paid by consumers in other parts of the country where the gas-works were less favourably situated than we were as regards coalfields.

Mr. *Kenneth Henderson*, chartered accountant, said he had fully investigated the accounts of the Company, and had made exhaustive inquiries of the same nature as had already been described by Mr. Gowans. As to the cash actually subscribed for the undertaking, of the 3750 shares which had been issued up to 1908, only 2562 had been issued for cash. His statement showed the total cash subscribed up to June 30, 1919, was £6312 14s. He learned that the undertaking had been valued in 1908 by Mr. M'Lusky, then of Perth, at £9553 5s. 11d.; and this was given effect to in the Company's balance-sheet by writing-up the old figure to the amount of this valuation, and thereby creating a reserve which the Company ear-marked as a balance. This reserve was £3643 3s. 4d., which really represented the difference referred to. It was reduced by writing-off £553 5s. 11d. as depreciation of property, which had the effect of bringing Mr. M'Lusky's valuation figure down to the round sum of £9000. Then other small items reduced the reserve balance to £2901, to which was added a sum of £300 appropriated from profits in 1911. From that time forward, there had stood every year in the balance-sheet a sum of £3201 for what was called reserve balance, which really was the remains of the valuation in 1908. He agreed that the yearly accounts required reconstruction, as they had not been kept in the manner prescribed by the Gas-Works Clauses Act. The accounts annually submitted to the shareholders did not correctly represent the Company's affairs. In particular, every year there had been a large item entered for depreciation. These sums totalled £3840. Four sums aggregating £506 for fittings were written-off against gas sales before the Company brought to account the revenue from the sales. As to capital expenditure, according to his statement, the undertaking was increased to an amount of £7859 during the six years 1908 to 1914; and of this the shareholders were called on to subscribe £3750, and the consumers £4109. Judging the value of the shares by the price at which they were changing hands in 1914, 25s. could be taken as a fair average. Since then it had risen to 35s., with a highest record of 36s. Going fully through his statements, he said the net result was that, whereas Mr. Gowans brought out a profit of £1599, his own figure was £1311 12s. 3d. He computed the manager's salary, with emoluments, house-rent, and taxes, at £154 4s. 4d.; of which he allowed one-sixth to go to repairs and maintenance, as suggested by Mr. Gowans. To the remainder of £127 13s. 6d., however, he added £55, being the amount he considered required to be added for the efficient management of the concern. For the actual £45 for salary of secretary he substituted £89, as being the estimate of what such a servant of the Company ought to have to keep the books properly and attend to the general duties. His ultimate figure of £1311 he certainly did not look upon as a maintainable profit, because the Company had done what a statutory company could not have done. They were unrestricted as to the price and quality of gas; and in a great many cases had put the price up to meet their capital extensions. In the account year, they had appropriated £425 5s. from profits to meet part of this capital outlay. Deducting this from the £1311, he arrived at the figure of £886 7s. 3d. as the permanently maintainable profit. He did not, however, think it was right or fair to take the profit of only one year when considering the factor that was to form the basis of capitalization.

Further examined, witness stated that he had gone very closely into the question of the multiplier. According to his knowledge and experience, there was a recognized distinction between the number of years' purchase for a statutory and non-statutory undertaking; and he put it at 2½ years. He handed in a table showing the returns on Government and other first-class investments, the effect of which, assuming that the statutory company was fairly represented by the stocks quoted, was to bring out a figure of 12 years for a non-statutory undertaking. This he arrived at by taking 14, which he considered to be quite a fair multiplier to apply to a statutory company, deducting 2½ years for the non-statutory company, and adding ½ year for disturbance.

Mr. CONSTABLE: While, no doubt, an undertaking of this kind is valued upon the well-known and established principle of maintainable profit, do you think that the price at which the shares have been passing in the market is a factor that can be well left out of account?

Witness: It is certainly a factor that must be taken into account. Proceeding, he said that prior to 1914 there were no shares passing at more than 25s. each; and this price, if applied to the whole of the share capital, would have brought out a sum of £9375. The figure which his multiplier of the maintainable profit brought out, exclusive of the two workmen's houses, was £10,636 7s. This was after applying a multiplier of 12, and subject to the full deduction of the capital expenditure during 1913-14. This amount in Gas Light and Coke Company's 4 p.ct. consolidated stock, for example (with a yield of over 7 p.ct.), would give the shareholders slightly under £800; whereas the dividend paid by the Company, adding on income-tax, for the five years up to June, 1914, averaged £697 14s.

Mr. MONCRIEFF (in cross-examination): Are you not rather startled by the fact that Mr. Herring, an expert, should have advised the Council to give nearly £16,000 for an undertaking which you ask the tribunal to-day to assess at a little over £10,000?

Witness: I think not. One has to remember that conditions were very different then from what they are to-day. The whole value of money was different.

Do you draw any real distinction between the capital subscribed in cash and the capital realized from profits which in fact were not distributed?—I think one must draw such a distinction.

Though passing that moral judgment, can you dispute that when the Company in 1910 issued shares to the amount of £3750, there were assets available against these shares; and these assets are valued equivalent to the value of cash?—Evidently so. He certainly thought the record of the transfer of shares was a most important factor in determining the value of such an undertaking.

Surely if a man sells a share in an undertaking which has a reserve of which he does not know, he is likely to take a smaller price than if he knew of the fact of the reserve?—I daresay there is something in that.

On what assumption did you debit against the Company as being an expenditure from revenue an increased salary to the management?—Having regard really to the profit, as to whether that would be maintainable.

Was not your view that for so small a price a good manager could not be obtained?—My opinion was rather that you could not possibly expect to run these works efficiently, or with any regard to security, by only paying such a small pittance of a wage to the manager.

Was it on the footing that since 1914 salaries and wages had substantially increased?—I had no regard to that at all.

Though greater expenditure upon management might reasonably have been reflected in increase of profits, have you given any credit on the profit side of the transaction for the result of the increased expenditure which you have estimated as reasonable?—No, certainly not.

Witness was cross-examined as to the figure of 7½d. per 1000 c.ft. which was included in his statement for repairs and maintenance; and as to the multiplier adopted. He admitted that he had never heard of a place like East Wemyss and Buckhaven where a gas company of some fifty years' standing had suddenly found themselves faced by a rival. His previous professional experience with gas companies' accounts was very slight.

The remainder of the Town Council's case will be dealt with next week.

INCREASED GAS OUTPUT AT BOLTON.

Doctors and Gas-Fires.

Reporting to the Bolton Corporation, Mr. W. J. Smith (the Gas Engineer and Manager) says that the gas sold up to date for the financial year shows an increase of 14 p.ct., and this would have been further increased had it been possible to obtain and fix all the gas apparatus required. Manufacturers of gas apparatus, on the one hand, have been unable to cope with the popular demand for cookers, fires, circulators, &c.; and, on the other hand, gas undertakings have been unable to obtain the number of efficient gas-fitters needed. Gas has very serious opposition to face; but, with fair competition and unbiassed decisions, it has been proved over and over again to be undoubtedly the cheapest and most satisfactory for domestic purposes.

In 1913, the Corporation made a special canvass of the doctors, explaining the scientific developments in design of the modern gas-fire, and consequently the improved hygienic conditions. The following table shows the results obtained:

Year.	Doctors Using Fires.	Fires Used by Doctors.
1913	46	91
1920	58	183
Increase	12	92

The above figures show conclusively the satisfaction produced by the use of the modern gas-fire, and further prove that the Gas Sales Department is very necessary for the efficient working of the undertaking. The Sales Department has been working since 1913; but the staff was considerably depleted during the war, with subsequent slow progress. Despite this, since its formation there have been obtained orders for 3085 gas cookers, 3845 fires, and 1383 wash-boilers, besides other apparatus.

THE MINERS' STRIKE.

Position of Gas Undertakings.

The Birmingham Gas Committee made an urgent appeal to manufacturers and domestic consumers to reduce their consumption by one-half; and this has led to short time in a large number of industries. The question of a further drastic curtailment in the supply of gas to consumers was considered last Friday; but it was decided to permit matters to remain as they were for a few days longer, in order to ascertain the result of the shorter hours in the factories. Unfortunately, the position has been complicated by the effect of the colder weather, as a result of which, despite the appeal for economy, about 9 million c.ft. more gas was consumed in the city from Monday to Thursday than during the same portion of the previous week. Manufacturers are asked to discontinue consumption of gas after 4 p.m.

Bradford public lighting was reduced by 50 p.ct. last week, in consequence of the coal strike, as a precautionary measure in case of a long dispute, though coal supplies at the gas department are very satisfactory. Doncaster public lighting, both by gas and electricity, has been reduced by about 50 p.ct.; and business people have been asked to restrict the lighting of shops and other business premises. The prohibition of advertisement lights was brought into force early in the coal-strike period. The gas-works are better placed for coal supplies than is the electricity undertaking, and can carry on comfortably for probably another month. Public street lighting at Hebden Bridge and Mytholmroyd has been reduced 50 p.ct.; and Halifax public lighting is reduced to the war-time basis.

The Keighley municipal gas and electricity undertakings are stated to be now so well placed for coal stocks that five weeks' supply of gas and electricity is assured, even without any definite restrictions by the authorities.

The Directors of the Bristol Gas Company appeal strongly to consumers to exercise the utmost economy, even under the conditions of reduced pressure; so that the supply may last out, not only through the strike, but through the period immediately afterwards, when new supplies of coal are being got in.

Up to last Monday, none of the important gas supplies in Ireland had been seriously interfered with as a result of the coal strike; but stocks of coal are not too plentiful, and close restrictive action is being discussed—especially in view of the fact that imports of coal are likely to stop this week, if the strike should continue. The operation of the Emergency Orders, of course, has led to curtailed consumption of coal, gas, and electricity in domestic, business, and industrial life.

Owing to the strike, and the consequent closing of Brancepeth Colliery gas-works, there has been no gas in Willington Quay since Sunday week.

After discussion by the Newcastle Corporation Lighting Committee, it was decided, in view of the strike, to reduce the street lighting by 50 p.ct.; it being left to the Chief Constable to determine which lights it was necessary to retain in the interests of public safety. The Newcastle and Gateshead Gas Company have considerable supplies of coal on hand; but consumers are urged to economize to the greatest possible extent.

The Reading Gas Company by means of published notices urge consumers to economize, not only in order that the supply of gas may be maintained during the strike, but also because it is imperative that as much as possible of the coal at present in stock at the gas-works should be preserved for use later on in the winter, when, though the strike may be settled, supplies of coal will be limited. The following suggestions for economy are offered by the Company: No one should light a gas-fire in a bedroom except in case of illness. Two burners should not be lighted where one will do. Do not boil more water than is required. The number of rooms heated and lighted should be strictly limited. Gas-cookers: Block-tin utensils are preferable to iron. Do not allow the flame to rise round the sides of saucepans, kettles, &c., or use uncovered saucepans. Several dishes may be cooked in the oven at the same time. Do not heat it for one or two small dishes. Gas-fires: Where it is necessary to light a gas-fire, do not allow the flame to rise above the top of the fuel. Turn off the gas immediately a room is vacated. Mr. D. H. Helps (the Engineer and Manager), in an interview, expressed the opinion that their difficulties would not be so much in the immediate future, as later on in the winter, when, the strike having been settled, the stock of coal they had laid in to meet the heavy demand in the winter-time had been exhausted, and they would probably be unable to obtain supplies in sufficient quantity to meet the demand.

Clause 1. of the Coal and Fuel Emergency Order provides for the placing of coke and other fuels on the same footing as coal as regards conservation, distribution, and supply, and consumption upon business and industrial premises. The rationing of supplies of coke and manufactured fuels for domestic purposes if found necessary.

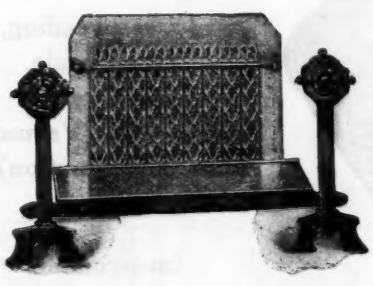
The street lighting in Manchester is to be reduced by one-half; the reduction to be carried into effect without delay.

Gas Lighting in London Housing Schemes.—The Housing Committee of the London County Council report that they have decided to employ gas for lighting purposes in the houses to be erected on the Bellingham and White Hart Lane estates. As regards Bellingham, terms have been agreed with the South Suburban Gas Company for the installation of a gas lighting system free of cost to the Council.

A Novel Substitute for Gas.—A novel substitute for gas has been introduced in the Wath-upon-Dearne district of the West Riding, where the gas supply failed, and candles and lamps were in general use for household purposes. At the St. James's Church Harvest Festival last Friday night, a number of pit-lamps were borrowed from the Manvers Main Colliery, which was standing through the miners' strike, and these obviated the service having to be postponed.

"How do I Fit this Fire?"

YOUR fitter will not have to puzzle over this question if it is an "Entente." To see is to understand.



The "Entente" can be raised or lowered and projected or contracted to suit the height and depth of the grate.

The points of adjustment are easy of access. The adjustment is as simple as opening a window or drawer.

Simple, ingenious, effective, pleasing.

R. & A. MAIN, LTD.,

WORKS: Gothic Works, EDMONTON, N.18; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.
SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W. 1; 82, Gordon Street, GLASGOW; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 6, Narrow Wine Street, BRISTOL; 333, Queen Street, MELBOURNE.

COKE BREEZE FOR GENERATING ELECTRICITY.

Low Fuel Costs at Hereford.

An interesting article appears in "Electrical Industries" on "Electrical Developments at Hereford." One of the chief departures from common practice is in the boiler-house, where coke-oven breeze is used as fuel. On this point the writer of the article says:

The coke breeze is generally regarded as waste, owing to its moderate calorific value, and the difficulty of burning it in ordinary furnaces. Mr. W. T. Kerr, the Electrical Engineer, has shown, however, that it can be very economically employed. The average cost last year was 11s. 2d. per ton; but the price is now, on account of increased railway charges, between 15s. and 16s. Several sources of supply in Wales and elsewhere are available; and Mr. Kerr has been able, without difficulty, to accumulate enough to last the station for six months. As there are no bituminous constituents, no risk of fire is involved in storage. Truck loads are dumped into a hopper, whence the dust is taken by a Babcock and Wilcox conveyor to ferro-concrete bunkers. Underfeed stokers and Stirling boilers are used with both induced and forced draught. The clinker is removed in trucks, which are elevated and dumped into a bunker, from which the material is later drawn into railway trucks or carts for removal. The clinker forms excellent road material, and is useful also in making concrete; so there is little difficulty in disposing of it. Mr. Kerr ascertained, moreover, that the flue-dust contains 6 p.ct. of potash, and is therefore readily marketable to farmers at about £3 per ton.

To maintain a satisfactory fire with coke-oven dust is an art which is not readily acquired. Mr. Kerr, with his assistant (Mr. Watson) found the initiation arduous enough; but they have had the satisfaction of succeeding to such a degree that the fuel costs per unit generated are down to the remarkably low figure of 0·34d. The figure would have been lower—lower, indeed, than that of any other supply undertaking in this country—if the output for 1919 had not been diminished by the closing-down of a munitions factory. As it stands, however, it is an achievement of which Mr. Kerr and his staff are entitled to be proud. The calorific value of the fuel is 9500 B.Th.U. per lb., and each of the three boilers works normally at 14,000 lbs. of steam, rising to 21,000 lbs. when forced during peak hours. Trials have already been made with an auxiliary oil-burner for peak loads; and they have been so satisfactory that all the boilers will be fitted. During 1919 over 4 million units were sold, at an average working cost of 0·99d. per unit.

The Chesterfield Gas Board have voted 100 guineas to Mr. J. W. B. Simpson, their Secretary and Accountant, for special services rendered in connection with the Fuel Control Order.

ENLARGEMENT OF THE ASTORIA GAS-WORKS ALMOST COMPLETE.

A recent number of the "American Gas Engineering Journal" referred to this matter in a brief article—pointing out that New York has the largest gas plant in the world, that of the Consolidated Gas Company at Astoria. But it was found two or three years ago that this was insufficient to meet the needs of the two boroughs, Manhattan and the Bronx. Plans were made for a fourth unit as an auxiliary to the other three; and this unit, which is to be completed by Dec. 1 next, will have a capacity of 30 million c.ft. daily. The present plant has a capacity of 50 millions every twenty-four hours; while the fourth unit adds 60 p.ct. to the total. The Company are also to start soon building another holder with the same capacity as the present one—15 million c.ft.—to be completed in 1922.

The new unit, which is for the manufacture of water gas, consists of a gas generator house, 367 ft. long, 87 ft. wide, and 70 ft. high; a tar extractor or condenser house, 40 ft. by 60 ft.; a boiler house, 90 ft. by 50 ft.; an engine house, scrubber houses, and other smaller buildings necessary for the complete process of the manufacture of gas. The final product—gas ready for consumption—is conveyed through a tunnel with a diameter of 25 ft., and over a mile in length, going under the East River to a big holder in the Bronx, whence it is distributed to all parts of the Bronx and Manhattan.

The Company have two units equally as large as the above described for making gas from the tar extracted from coal, and one other for the production of water gas.

The Company use 1,125,000 tons of coal per year; and as its price delivered to the plant has advanced from $3 to $12 per ton, the Company's coal bill has advanced from $3,375,000 to $13,500,000 per year. The Company have been able to get but a small supply, and have less reserve on hand than ever before at this season of the year. Labour has advanced 150 p.ct. The cost of the construction of the new building is double what it would have been before the war.

The Company's officials say that the quality of the gas is fully up to the standard of the past. The Company maintain a Chief Chemist constantly at work studying better and more economical methods of manufacture, and for the utilization of bye-products and the testing of materials. There is a high-class laboratory.

The Company have been trying to have the standard of gas measurement changed from the candle-power unit to the thermal standard. Better results can be obtained with the Welsbach burner under thermal system than under the candle-power method. This system is used in twelve or fifteen States and in all New York State outside New York City.

The use of gas for industrial purposes is constantly on the increase; and this more than makes up for the loss resulting from the falling-off in the use of gas for lighting puposes, due to the use of electricity. Its

USE Simmance's

DEAD BEAT INDICATORS

instead of WATER-TUBE GAUGES and

"READ THE PRESSURE BY THE POINTER."

No liquid to evaporate and no levels to adjust.

No glasses to break and nothing to clean.

Direct reading, Open scale, Any range (Pressure, Vacuum, or Combination).

Incorrodible, Accurate, for foul or purified gas.

MADE IN MANY RANGES WITH TABLETS LETTERED AS DESIRED.

ALEXANDER WRIGHT & CO., LTD., WESTMINSTER.

Agents: Australia—FYVIE & STEWART, 360, Collins St., Melbourne; Canada—W. P. ROPER, 502, Merchants' Bank Building, Montreal.

use for kitchen purposes is also largely increasing. The Company are constantly investigating new methods for the use of gas for industrial and household purposes.

The Company supplied the Government with over 1½ million gallons of toluol, used in the making of high explosive shells, and 5 million gas-masks during the war. Almost all these supplies for use abroad were made directly by the Company or from material furnished by the Company.

TRADE NOTES.

[For "Journal" Advertisers.]

Richmond's Silent Gas-Fires.

The Richmond Gas Stove and Meter Company send a copy of their 36-page booklet illustrating and describing their gas-fires for the present winter season. The cover (in photogravure) is from a photograph of one of the rooms at their London showrooms in Queen Victoria Street. Nearly all the gas-fires shown in the booklet are also illustrated in appropriate mantles; and here, again, the photographs are taken from examples in their own showrooms. This method of illustration enables the consumer to at once appreciate what the appearance of the fire will be when fixed in the home.

Messrs. Perry & Co. (Bow), Ltd, are now erecting Perry plants for the complete gasification of coal, and for producing blue or carburetted water gas, at Harwich, the Mid-Kent Gas-Works (Snodland), Gorleston (second plant), Sutton-in-Ashfield, Wrexham, Earby (Yorks), Ballina (Ireland), Cleveland Gas Company (Skinningrove), &c.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Oct.* 25.

London tar products are in a very steady position. Shipments are being made with considerable rapidity, in consequence of favourable rates of freight, while the price is maintained at over 220s. net per ton f.o.b. at works. Creosote is somewhat scarce, and is quoted at 1s. 4d. net per gallon in bulk. There is nothing to report as to other tar products, nor any change in the position of sulphate of ammonia for agriculture.

Tar Products in the Provinces.

Oct. 25.

The average values for gas-works' products during the week were: Gas-works coal tar, 130s. to 135s. Pitch, East Coast, 217s. 6d. to 220s. per ton f.a.s.; West Coast—Manchester, 200s. to 210s.; Liverpool, 200s. to 210s.; Clyde, 205s. to 215s. nominal. Benzole 90 p.ct. North, 3s. 1d. to 3s. 2d.; crude 65 p.ct. at 120° C., 2s. 3d. to 2s. 5d. naked at makers' works; 50-90 p.ct. naked, North, 3s. 2d. to 3s. 3d. Toluol, naked, North, 3s. 1½d. to 3s. 2½d. nominal. Coal tar crude naphtha in bulk, North, 1s. 2d. to 1s. 3d. Solvent naphtha, naked, North, 3s. to 3s. 2d. Heavy naphtha, North, 3s. 1d. to 3s. 3d. Creosote, in bulk, North, liquid, 1s. 0¾d. to 1s. 1¾d.; salty, 1s. to 1s. 1d. Heavy oils, in bulk, North, 1s. 1d. to 1s. 2d. Carbolic acid, 60 p.ct., 3s. 3d. to 3s. 6d. Naphthalene, £37 10s. to £40; salts, £10 to £10 10s., bags included. Anthracene, "A" quality, 1s. per minimum 40 p.ct.; "B" quality, nominal.

FROM A MARKET CORRESPONDENT.

Tar Products.

The market in tar products has been very much disturbed by the coal strike, and business is almost at a standstill. Higher prices prevail for the small supplies of most materials available. Pitch, where available, remains strong. South Wales buyers are willing to pay £12 10s. per ton for forward delivery, and even more than this has been paid in the Midlands. There seems to be no definite change in solvent naphtha, and the demand from rubber manufacturers is still very poor. Naphthalenes, when offered, are quickly taken up; but one does not hear of any general advance in price, although £60 per ton is sometimes mentioned as the value of flake. Stocks of creosote are small, and are being held for fully 1s. 6d. per gallon. Anthracene is dear, and now makes 1s. 4d. per unit per cwt. Benzole is steady, and stocks correspondingly light. When trade conditions improve, some increase in output is looked for. Pure benzoles and toluol are in request.

Latest values are as follows:

Benzole: 90% London 3s. 5d. to 3s. 7d., North 3s. 4d. to 3s. 6d.; 50-90% 2s. 8d. to 2s. 10d. London, 2s. 7d. to 2s. 9d. North; crude 60-65%, 1s. 7d. to 1s. 9d.; pure, 4s. per gallon naked.

Crude Tar: London, 105s. to 115s.; Midlands, 107s. 6d. to 117s. 6d.; North, 105s. to 115s. per ton *ex* works. Refined tar, 95s. per barrel (free) on rail.

Pitch: London, 225s. per ton f.o.b.; East Coast, 215s. per ton; West Coast, 215s., with Manchester 200s. per ton, and Glasgow 210s. per ton; South Wales, 222s. 6d. per ton.

Solvent Naphtha: London, 3s. 6d.; Provinces average 3s. 4d. per gallon.

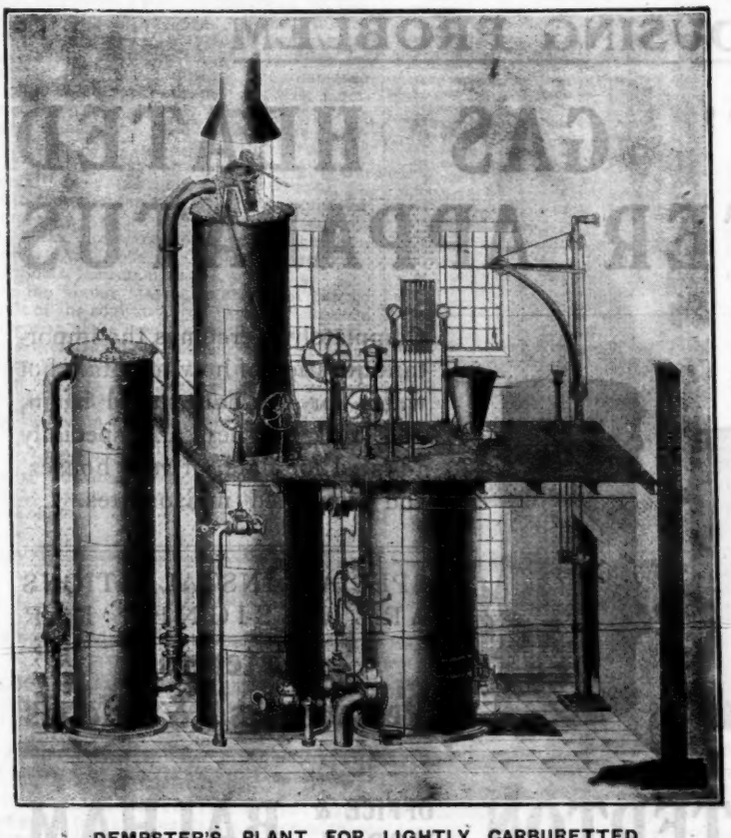
Crude Naphtha: Naked, 10d.; North, 9d. per gallon.

Heavy Naphtha: 3s. 6d. per gallon.

Naphthalene: Refined flake, £60 per ton nominal; inferior, £35; crude, £18 to £35 per ton, according to quali.

Toluol: Naked, 2s. 11d. per gallon nominal; N[illegible]. 9d.; pure, 4s.

Creosote: London, 1s. 2d. to 1s. 3½d.; North, 1s. 2½d.; heavy oil, 10½d. per gallon in bulk.



DEMPSTER'S PLANT FOR LIGHTLY CARBURETTED WATER GAS.

DEMPSTER'S
COMBINATION OF
BLUE AND
CARBURETTED
WATER GAS
PLANTS

THE BEST FOR
EFFICIENT
AND ECONOMIC
RESULTS.

R. & J. DEMPSTER, LD.,
GAS PLANT WORKS,
MANCHESTER.

Telephones: 54 and 2296 CENTRAL.
LONDON TELEPHONE: VICTORIA 7426.

Anthracene: 40-45%, 1s. 4d. to 1s. 6d. per unit per cwt.
Grease Oils: 18° Tw. (naked), £6 10s. per ton f.o.r. makers' works.
Pyridine: 20s. to 25s. per gallon.
Aniline Oil: 1s. 8d. per lb., drums extra.
Aniline Salts: 1s. 11d. per lb.
Cresylic Acid: 95%, 4s. 9d. to 5s. 3d.; 97-99%, 5s. 6d. to 5s. 9d. per gallon *ex* works London, f.o.b. other ports.
Carbolic Acid: Crude 60%, 3s. 4d. per gallon; crystals 40%, 10d. per lb. nominal.
Salicylic Acid: Technical, 2s. 6d.; B.P., 3s. 3d. per lb.
Xylol: Pure, 6s. 9d.; commercial, 5s. 9d. per gallon.

Sulphate of Ammonia.

There is a very fair demand for the time of year, and, despite the advancing quotations, there looks like a continuance of good business as the season goes on. Export trade also is looking up; about £35 per ton being the average obtained. Higher figures are mentioned in some quarters, and could be obtained but for offers made, and business done, by one country with an exportable surplus. The total export from Great Britain in September was 13,250 tons, compared with 11,609 tons in September last year and 28,111 tons for the last complete pre-war year. Last month our best customer was the Dutch East Indies, with 4278 tons. Then came Italy, with 2440 tons, followed by Spain and the Canary Islands, with 1771 tons. The total exports for the month ended Sept. 30 amounted to 76,118 tons.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official List" for Oct. 20.]

Nos. 28,687—29,323.

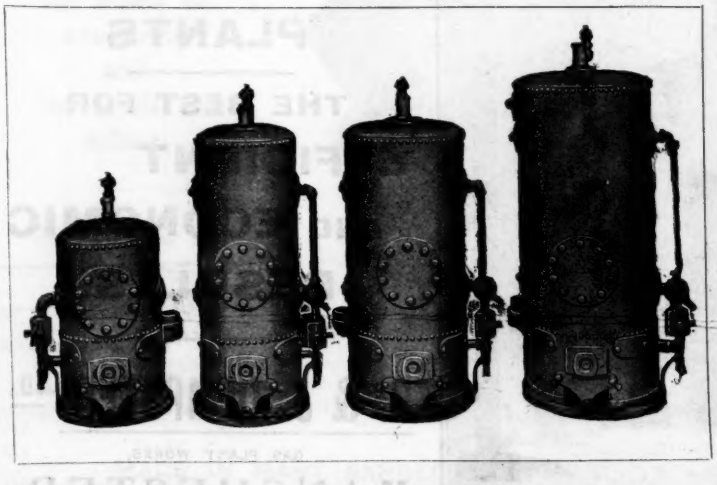
AIRD, K.—"Atmospheric gas burners, and gas fuel for use therewith." No. 28,911.
AIRD, K.—"Gas-burners for stoves." No. 29,209.
ANDERSON, J.—"Fixing diaphragms in dry gas-meters." No. 28,755.
ASKHAM, W.—"Machine for manufacturing incandescent gas mantles." No. 28,855.
FARBENFABRIKEN VORM. F. BAYER & Co.—"Process for obtaining sulphur or treating and purifying gases containing hydrogen sulphide." No. 29,215.
FONBLANQUE, L. DE.—"Manufacture of illuminating gas and bye-products." No. 29 250.
FONBLANQUE, L. DE.—"Treatment of peat." No. 29,253.
FOX, A.—"Gas-burners." No. 29,238.
GLOVER, S.—"Vertical retorts for destructive distillation of carbonaceous materials." No. 29,307.
KOPPERS COMPANY.—"Purification of liquids." No. 29,013.
M'EWEN, S.—"Carbonization of subdivided fuel." No. 28,778.
MASSON, P. W.—"Gas heating-apparatus." No. 29,087.
MOELLER, J.—See Fonblanque. Nos. 29,250, 29,253.
MOND, A.—"Electrical precipitation of suspended particles from gaseous media." No. 29,185.
NEWTON, C. F.—"Apparatus for reading or recording pressures at a distance." No. 29,146.
RICHARDSON, T. H.—See Askham. No. 28,855.
RUDOLF, E.—"Gas-oven." No. 29,040.
SEARS, S. A.—"Regenerative chamber for furnaces using producer gas, &c." No. 28,816.
UNDERFEED STOKER COMPANY.—See M'Ewen. No. 28,778.
WEST, J.—See Glover. No. 29,307.
WEST'S GAS IMPROVEMENT COMPANY.—See Glover. No. 29,307.
WORTLEY, G. W.—"Atmospheric gas-burners, and gas-fuel for use therewith." No. 28,911.
WORTLEY, G. W.—"Gas-burners for stoves." No. 29,209.

A Thirty-Eight Hour Week Refused.—The Bolton Corporation Gas Committee received a deputation from the Bolton and District Gas-Workers' Association, in reference to the following application of the members of the Association employed as auto. attendants in the Lighting Department: "38 hours to constitute a full week's work. The same annual holidays with pay (irrespective of week-ends off) as those enjoyed by the day workmen in the Bolton Lighting Department. The same amount of wages per week as that paid to auto. attendants by the Liverpool Corporation." A statement showing the wages paid and the conditions of employment of the lamplighters engaged by the Bolton Corporation, as compared with the wages and conditions of employment of lamplighters in the service of the Liverpool Corporation, was submitted. The Committee could not see their way to accede to the application.

Increased Expenditure at Barry.—There was some discussion at a recent meeting of the Barry Urban District Council regarding an estimated deficiency of £7000 on the gas and water undertakings for the ensuing half year. The estimated increased expenditure of £9044 represented wages, coal, oil, and stores; and the figure was reduced to £7000 by increased receipts from residuals. Recently, however, by virtue of a sale of coke for shipment, a clear £1000 was made over and above a figure which would have been realized had it been retailed in Barry. Mr. C. B. Griffiths presented comparative figures of the prices of coke and gas at Barry and other towns in the vicinity, showing that Barry's were the lowest. In the course of a lengthy statement it was intimated by him that, by increasing the price of coke from 30s. to £2 per ton, an increased revenue of £1500 would be obtained; and a similar amount would also be acquired by reducing the discount at present allowed ordinary gas consumers from 10 to 5 p.ct., and reducing the amount allowed for a penny to slot-meter consumers from 14 to 13 c.ft. This was agreed to.

THE HOUSING PROBLEM

"VICTOR" GAS HEATED HOT WATER APPARATUS



Completely overcomes the important question of how to obtain hot water for the bath, hand basin, and sink. They are specially adapted for flats, private houses, and converted maisonettes.

SPECIAL INSTALLATIONS ARE DESIGNED FOR
Caterers,
Restaurants & Hotels

THOMAS POTTERTON, OFFICE & WORKS, BALHAM

STOCK MARKET REPORT.

THE Stock Exchange has had a rather anxious period, as might be expected during the first week of the coal strike; but it maintained its calm to a remarkable degree. It goes as a matter of course that business was reduced to very meagre proportions, and the general tone was dull; but there was no pressure to sell at slaughter-house prices, and from time to time the old persistent feelings of hopefulness would come to the surface and things take a brighter turn.

The gilt-edged market received a very fair measure of support. Home Government issues came out favourably. The big four closed practically without any change—viz., Consols 45 45½. War Loan 84⅝-85. Funding 67¼-67⅜. Victory 73 7/16-73 13/16. Bonds were in demand, and Corporation fairly steady. Home Rails and Argentines were lower.

In the Foreign Markets there were irregular movements. French had a little help from exchange. Belgian, Brazilian, Chinese, and Japanese were firm; but Italian lowered.

The Miscellaneous Market was rather stronger on the whole. Rubbers were somewhat mixed; but Oils had good support. Among Industrials, which were firmer, Iron and Steel and Textiles were noticeable.

Business in the Gas Market was quiet, and was almost monopolized by the three biggest undertakings; all the rest contributing only about a score of transactions between them. Prices were again a little easier; but less than might be expected when the gas industry is confronted with a coal strike. Gas Light Ordinary was only 1 lower, and South Metropolitan was 3 lower. In the Suburban and Provincial group, South Suburban was put down 1, and Tottenham "B" 3. In Continentals, Continental Union was 2 lower, and Imperial Continental 3. Primitivas were hardly noticed, and were unchanged.

Bargains done for cash during the week were as follows: On Monday, Commercial 3½ p.ct. 47½, Gas Light ordinary 49½, 50, 50½, 50¼, 50⅜, 51, ditto debenture 45⅜, Imperial Continental, 128, 129¼, Primitiva 10s., South Metropolitan 56½, 57, 58¼, 59. On Tuesday, Brentford "A" 52, 52½, Gas Light ordinary 50, 51, Imperial Continental 126, 127, 128, 128½, 129, Primitiva preference, 20s. 7½d., South Metropolitan 126, 127, ditto debenture, 46½, 46½. On Wednesday, Commercial 4 p.ct. 56, European 6⅜, Gas Light ordinary 49⅜, 50, 50½, 50¼, ditto preference 58, Imperial Continental, 125½, 126½, 127¾, South Metropolitan, 56¼, 57, ditto debenture 47. On Thursday, Bournemouth 10 p.ct. 8⅜, 8½, Brentford "A" 52½, Commercial 4 p.ct. 55¾, 56, European 6⅜, Gas Light ordinary 50⅜, 51, ditto debenture 46, 47, Hong Kong and China 8 13/16, 8⅞, Ilford "A" and "C" 80, Imperial Continental 126½, 127½, Monte Video 71½, Primitiva debenture 69¾, 70, South Metropolitan 56⅜, 57, Southampton debenture 53, 53½, Wandsworth "B" 56½, 57. On Friday, Brentford "A" 55, Gas Light ordinary 50½, 50⅜, Imperial Continental 126, 126½, 127, South Metropolitan 56½, 57, 57½, 58.

In the Money Market, as an almost natural result of the coal strike checking industry and enterprise, there was a superabundant supply and a greatly reduced demand, and short loans might be had at very easy rates. Discount terms were in like case. Silver had a sharp fall, followed by an equally sharp recovery. The Bank rate is 7 p.ct., fixed on April 17.

The Ilford Gas Company have been fined 40s. at Stratford for having an unjust 56 lb. weight. It was stated that the weight was 9½ oz. light.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Ante-War Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices, July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
£			p.c.					
182,049	Stk.	Aug. 27	4	4%	Aldershot 4 p.c. Pref.	...	56—61	...
1,551,868	,,	Oct. 14	2½	3 1/18%	Alliance & Dublin Ord.	59—64	36—41*	...
374,000	,,	July 14	4	4%	Do. 4 p.c. Deb.	76—79	47—52	...
280,000	5	May 13	7½	8%	Bombay, Ltd.	5⅛—6⅛	4⅛—5	...
50,000	10	Aug. 12	16	5%	Bournemouth Gas and Water: 10 p.c.	29—30	8—9	8⅛—8½
383,110	10	,,	7	7%	Bournemouth Gas and Water: B 7 p.c.	15—15½	8½—9½	...
115,000	10	,,	6	6/-	Bournemouth Gas and Water: Pref. 6 p.c.	13½—14	7½—8½	...
162,065	—	June 25	—	4%	Bournemouth Gas and Water: 4 p.c. Deb.	...	62—64	...
992,045	Stk.	July 14	14	30/-	Brentford A Consolid.	261—266	50—55	52—55
734,920	,,	,,	11	26/3	Do. B New	204—209	47—52	...
55,000	,,	,,	5	5%	Do. 5 p.c. Pref.	109—111	68—73	...
221,400	,,	June 10	4	4%	Do. 4 p.c. Deb.	91—93	60—63	...
214,775	,,	Aug. 27	11	7½%	Brighton & Hove Orig.	208—213	120—125	...
244,200	,,	,,	8	5⅛%	Do. A Ord. Stk.	154—159	78—83	...
1,287,500	Stk.	July 29	5	5%	Bristol 5 p.c. max.	...	...	...
530,000	20	Sept. 15	12½	10%	British	44—45	20—22	...
120,000	Stk.	June 25	4	4%	Do. 4 p.c. Deb. Stk.	88—90	57—59	...
245,771	,,	,,	4	4%	Buenos Aires 4 p.c. Deb.	85—87	42—45	...
100,000	10	May 27	—	—	Cape Town & Dis., Ltd.	1½—2½	7—7½	...
100,000	10	,,	—	4½%	Do. 4½ p.c. Pref.	4—6	5½—6½	...
100,000	Stk.	June 25	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	56—61	...
157,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	...	...
1,513,280	,,	Aug. 12	5/9/4	30/-	Commercial 4 p.c. Stk.	106—108	54—59	55½—56
560,000	,,	,,	5½	26/3	Do. 3½ p.c. do.	103—105	47—52	47½
475,000	,,	June 10	3	3%	Do. 3 p.c. Deb. Stk.	69½—71½	45—47	...
800,000	,,	Dec. 11	4	—	Continental Union Ltd.	76—79	25—30	...
200,000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	40—50	...
51,600	,,	Aug. 27	14½	10½%	Croydon A 10 p.c.	...	125—135	...
278,400	,,	,,	11½	7½%	Croydon B and C 7 p.c.	...	85—95	...
492,270	Stk.	—	6	5%	Derby Con. Stk.	123—125	...	...
55,000	,,	—	4	4%	Do. Deb. Stk.	102—104	...	...
1,002,180	10	Jan. 29	10	5/-	European, Ltd.	17½—18	6½—7½	6⅞
16,298,975	Stk.	July 29	4/17/4	30/-	Gas Light and Coke: 4 p.c. Ord.	98—102	49—52	49½—51
2,600,000	,,	,,	3½	26/3	Gas Light and Coke: 3½ p.c. max.	76—79	39—42	...
4,062,235	,,	,,	4	4%	Gas Light and Coke: 4 p.c. Con. Pref.	96—99	55—58	58*
4,674,850	,,	June 25	3	3%	Gas Light and Coke: 3 p.c. Con. Deb.	72½—74½	45—48	45⅞—47
130,000	,,	Dec. 11	10	10%	Gas Light and Coke: 10 p.c. Bonds.	...	...	...
82,500	,,	Sept. 15	5	3⅛%	Hastings & St. L. 5 p.c.	...	53—58	...
258,740	,,	,,	3½	2⅛%	Do. 3½ p.c.	87—89	37—39	...
70,000	10	May 13	11	8%	Hongkong & China, Ltd.	16½—16¾	8¼—9¼	8⅛—8⅜
86,600	Stk.	Sept. 15	9	5⅝%	Hornsey 7 p.c.	...	87—89	...
131,000	,,	Aug. 12	7½	4⅝%	Ilford A and C	151—154	79—84	80
65,780	,,	,,	6½	3⅛%	Do. B	115—118	64—69	...
65,500	,,	June 25	4	4%	Do. 4 p.c. Deb.	92—94	55—58	...
4,940,000	,,	May 14	9	4½%	Imperial Continental	150—160	123—130	125½—129½
1,235,000	,,	Aug. 12	3⅜	3⅛%	Do. 3½ p.c. Deb. Red.	84—86	82—87	...
235,242	,,	Sept. 15	6½	5%	Lea Bridge Ord. 5 p.c.	119—121	80—85	...
2,498,905	,,	Feb. 26	10	37/6	Liverpool 5 p.c. Ord. A.	211—213	...	...
					Liverpool 5 p.c. Ord. B.	146—148		
306,083	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	...	...	...
165,736	,,	Aug. 12	7/3/6	3⅛%	Maidstone 5 p.c.	...	52—57	...
75,000	5	June 11	.6	3%	Malta & Mediterranean	4⅛—4⅜	1⅜—2⅛	...
250,000	100	Oct. 1	4½	4½%	Met. of Melbourne 4½ p.c. Deb.	99—101	86—93	...
341,920	Stk.	May 27	4	6%	Monte Video, Ltd.	11½—12	70—75	71½
1,875,892	,,	July 29	4½	3⅛%	Newcastle & Gatsh'dCon.	98½—99½	61—63	...
529,705	,,	June 25	3½	3⅛%	Do. 3½ p.c. Deb.	82—83	50—51	...
15,000	10	Sept. 15	—	8%	North Middlesex 10 p.c.	...	12½—13½	...
55,940	10	,,	7/14/0	5⅛%	,, ,, 7 p.c.	14—15	7—7½	...
300,000	Stk.	May 13	8	8%	Oriental, Ltd.	117—122	98—101	...
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7⅝	2—3	...
60,000	50	Aug. 27	13	7½%	Portsea Island, B	128—131	65—70	...
100,000	50	,,	12	6¼%	Do. C	118—121	50—55	...
249,980	5	April 29	8	—	Primitiva Ord.	5⅛—6	⅞—1⅛	10/-
499,950	5	June 26	5	—	Do. 5 p.c. Pref.	4⅛—5	1—1⅛	20/7½
321,800	100	June 1	4	4%	Do. 4 p.c. Deb.	91—93	69—71	69⅛—70
600,000	Stk.	July 29	4	4%	Do.* ,, ,, 1911	...	40—42	...
346,198	,,	June 25	4	4%	River Plate 4 p.c. Deb.	85—87	38—43	...
150,000	10	Sept. 30	6	6/-	San Paulo 6 p.c. Pref.	10½—11	6½—7½	...
125,000	50	July 2	5	5%	San Paulo 5 p.c. Deb.	47—49	38—40	...
135,000	Stk.	Aug. 27	10	5%	Sheffield A	223—224	68—73	...
209,984	,,	,,	10	4%	Do. B	222—224	58—63	...
583,500	,,	,,	10	3⅛%	Do. C	220—222	53—55	...
133,201	Stk.	Sept. 15	4	4%	Shrewsbury 5 p.c.	...	...	...
90,000	10	Sept. 30	9	9%	South African	10½—11½	10½—11½	...
6,609,895	Stk.	Aug. 12	5/4/0	30/-	South Met. 4 p.c. Ord.	111—113	55—60	56—59
250,000	,,	July 14	—	5%	Do. Pref.	...	91—93	...
1,895,445	,,	,,	3	3%	Do. 3 p.c. Deb.	72½—74½	45—47	46½—47
224,820	,,	Aug. 27	8½	3%	South Shields Con. Stk.	157—159	93—96	...
1,087,795	,,	July 29	6	3⅛%	S'th Suburb'n Ord. 5 p.c.	114—116	57—62	...
247,558	,,	June 25	5	5%	Do. 5 p.c. Deb. Stk.	116—118	65—70	...
647,740	,,	May 13	7½	3⅛%	Southampton Ord.	99—102	57—60	...
121,275	,,	June 25	4	4%	Do. 4 p.c. Deb. Stk.	...	59—61	53—53½
120,000	,,	Aug. 12	—	3⅛%	Tottenham and District: A 5 p.c.	135—138	60—65	...
782,275	,,	,,	6	2⅛%	Tottenham and District: B 3½ p.c.	115—117	50—55	...
181,255	,,	June 10	4	4%	Tottenham and District: 4 p.c. Deb.	87—89	60—63	...
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	...
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	45—50	...
236,476	Stk.	Sept. 15	5	3⅛%	Tynemouth 5 p.c. max.	108½—109	69—71	...
					Wandsworth, Wimbledon, and Epsom—			
30,000	,,	Aug. 27	8½	47/6	Wandsworth A 5 p.c.	151—156	75—80	
255,636	,,	,,	6½	32/6	Do. B 3½ p.c.	129—134	53—58	56½—57
108,075	,,	,,	—	33/3	Do. C	...	50—55	...
140,865	,,	,,	—	33/3	New Ordinary	...	50—55	...
352,000	,,	,,	6½	26/3	Wimbledon 5 p.c.	117—122	43—48	...
98,000	,,	,,	6½	32/6	Epsom 5 p.c.	121—126	50—55	...
88,416	,,	June 25	3	3%	3 p.c. Deb. Stk.	66—69	44—47	...

* Ex Div.

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